November 19, 1956 50 Cents

AVIATION WEEK

A McGRAW-HILL PUBLICATION

Successful British Screamer Killed

•

Russian Parachute Features Tested

Lockheed 1649A, 1049H

FROM THE LAND, AND FROM THE SEA...

The Terrier Clears the Air!

Convair's versatile Terrier missile is now seeing land duty with the U.S. Marine Corps—affording you *new* and *mobile* protection! Already operational at sea with the U.S. Navy, the Terrier's new mobility is provided by launchers and handling equipment developed specifically for ground use. The Terrier gives the Marines tremendous and accurate firepower where they want it, when they want it—to destroy an invading aircraft.

Produced by **Convair-Pomona** in cooperation with the **U.S. Navy Bureau of Ordnance,** the Terrier now can clear the air from both land and sea for your protection!

CONVAIR

A DIVISION OF GENERAL DYNAMICS CORPORATION

The C-123 can't stop on a dime—

but it can land in 700 feet!

FAIRCHILD

AIRCRAFT DIVISION • HAGERSTOWN 10, MARYLAND

A Division of Fairchild Engine and Airplane Corporation

...WHERE THE FUTURE IS MEASURED IN LIGHT-YEARS!

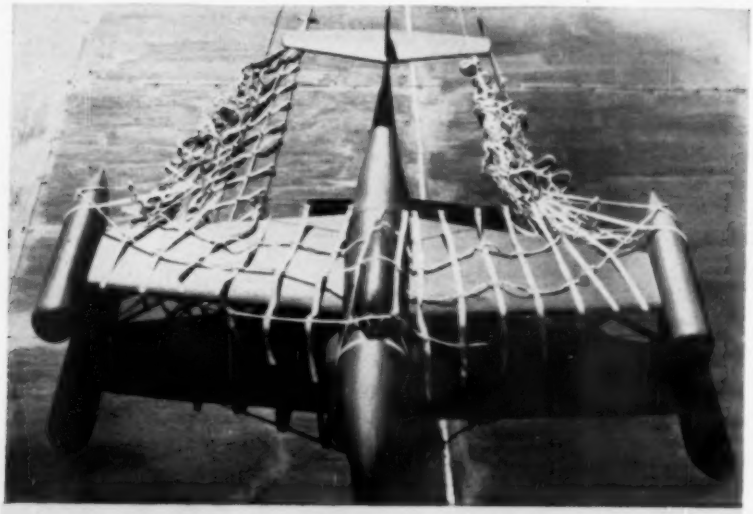
Meet the most agile, the most sure-footed transport in the world – the Fairchild C-123. It is capable of air-lifting up to 60 troops, or up to eight tons of bulk combat cargo – and it needs no mile-long concrete runway.

Almost any clearing, almost any field is a potential C-123 airbase; even deeply rutted, ungraded, or sandy grounds are taken in stride by this rugged ship. And sophisticated aerodynamic design makes possible a landing run of only 700 feet – a takeoff run only a little longer.

Performance, ruggedness, payload and versatility . . . these are traditional hallmarks of Fairchild aircraft.

ENGINEERS

for absorbing problems



For over 16 years, All American Engineering has specialized in the service of taking on tough engineering assignments for the aviation industry and the military. Knotty problems in the field of energy absorption – like those involved in the arresting gear project shown here – have become a speciality.

Engineers are needed now. Because All American offers a complete engineering and development service, work assignments are rarely routine. They concern really challenging engineering problems. In the past these have ranged over energy absorption devices, seat ejection trainers, air pick up equipment and various types of air-borne winches. Investigate for yourself the opportunities at All American.

ALL AMERICAN PROJECTS IN ENERGY ABSORPTION

Undergoing rigorous tests is this electronically triggered arresting gear known as the pop up barrier.

A totally new concept in energy absorption, the "water squeezer."

All American Engineering Company

DUPONT AIRPORT • WILMINGTON, DELAWARE

AVIATION CALENDAR

Nov. 25-27—Aviation Distributors & Manufacturers Assn., 28th Meeting, Drake Hotel, Chicago, Ill.

Nov. 25-30—Aviation Division, American Society of Mechanical Engineers, Annual Meeting, Hotel Statler, New York.

Nov. 26-27—International Meeting Canadian Aeronautical Institute and the Institute of the Aeronautical Sciences, Royal York Hotel, Toronto, Ontario.

Nov. 26-30—Human Engineering Conference, Third International Automation Exposition, Trade Show Building, New York City.

Nov. 29-30—1956 Operations Research Conference, Society for Advancement of Management, Hotel Commodore, New York, N. Y.

Dec. 5-7—Instrumentation Conference & Exhibit, sponsored by the Professional Group on Instrumentation and the Atlanta, Ga., Section, Institute of Radio Engineers, Biltmore Hotel, Atlanta, Ga.

Dec. 6-7—Third Annual Meeting, American Astronautical Society, Hotel Edison, New York, N. Y.

Dec. 7—Open House and Air Power Show, Myrtle Beach AFB, S. C.

Dec. 7—Symposium on Ecology of Air Transport, Institute of the Aeronautical Sciences, 7660 Beverly Blvd., Los Angeles, Calif.

Dec. 17—Annual Wright Day Dinner, Sheraton Park Hotel, Washington, D. C.

Dec. 28-31—Third King Orange International Model Plane Contest, U. S. Marine Corps Air Station, Miami, Fla.

Jan. 21-22, 1957—Symposium on Solar Furnace Design and Operation, Hotel Westward Ho, Phoenix, Ariz.

Jan. 28-31—8th Plant Maintenance & Engineering Conference, Public Auditorium, Cleveland, Ohio.

Feb. 7—Operations Research Symposium, University Museum Lecture Hall, University of Pennsylvania, Philadelphia, Pa.

Feb. 7—Annual Mid-Winter Symposium of the New York Section, Instrument Society of America, Garden City Hotel, Long Island, N. Y.

AVIATION WEEK • NOVEMBER 19, 1956
Vol. 65, No. 21

Published weekly with an additional issue in December by the McGraw-Hill Publishing Company, James H. McGraw (1860-1948), Founder. Executive, Editorial, Advertising and Subscription offices: **McGraw-Hill Building, 330 West 42nd Street, New York 36, N. Y.** Publication Offices: 99-129 North Broadway, Albany 1, N. Y. Donald C. McGraw, President; Paul Montgomery, Executive Vice-President; Joseph A. Gerardi, Executive Vice President and Treasurer; Hugh J. Kelly, Executive Vice President; John J. Cooke, Secretary; Nelson Bond, Executive Vice-President, Publication Division; Ralph B. Smith, Vice President and Editorial Director; Joseph H. Allen, Vice President and Director of Advertising Sales; J. E. Blackburn, Jr., Vice President and Circulation Director.

Subscription: Address correspondence to AVIATION WEEK—Subscription Service, 99-129 North Broadway, Albany 1, N. Y. or 330 West 42nd St., New York 36, N. Y. Allow 10 days for change of address.

Subscriptions are solicited only from persons who have a commercial or professional interest in aviation. Position and company connection must be indicated on subscription orders.

Single Copies 50¢. Subscription rates—United States and possessions, $6 a year; $9 for two years; $12 for three years. Canada $8 a year; $12 for two years; $16 for three years, payable in Canadian currency at par. Other Western Hemisphere and the Philippines $10 a year; $16 for two years; $20 for three years. All other countries $20 a year; $30 for two years; $40 for three years. Second class mail privileges authorized at Albany 1, N. Y. Printed in U. S. A. Copyright 1956 by McGraw-Hill Publishing Co. Inc. All Rights Reserved. Cable Address: "McGraw-Hill New York." Publications combined with AVIATION WEEK are AVIATION NEWS, AIR TRANSPORT, AERONAUTICAL ENGINEERING and AIRCRAFT JOURNAL. All rights to these names are reserved by McGraw-Hill Publishing Co.

One in a series about users of Phillips 66 Aviation Products

Phillips 66 LOOKS AHEAD with AMERICAN

A new concept of air travel time will result when American Airlines places its new Jet Airliners into operation in 1959. For example, a business man who is presently spending approximately 186 hours a year flying American from Los Angeles to New York and return once a month, will spend only a corresponding 108 hours a year when traveling on American Jet Airliners in 1959. His travel time will be more pleasant, too, thanks to the many new comfort and convenience features that will be incorporated into the new American Jet Airliner.

4½ HOURS - EAST BOUND *
PRESENT FLYING TIME 7 HOURS, 45 MIN.
4 HOURS - EAST BOUND *
PRESENT FLYING TIME 7 HOURS, 25 MIN.
NEW YORK
WASHINGTON
LOS ANGELES

*approximate time.

Today, Phillips 66 Aviation Gasoline gives dependable, efficient performance to American and other leading air lines, as well as to the military air services.

In step with the future, Phillips is a leading producer of *super performance* Jet Fuels for the latest designs in turbo-props and jets. And Phillips research continues to lead the way for development of fuels for the aircraft of tomorrow.

AVIATION DIVISION • PHILLIPS PETROLEUM COMPANY • BARTLESVILLE, OKLAHOMA

Right Combination . . .

ARC's Communication and Navigation Equipment for Your New Aircraft

Whether single or deluxe dual installations, you will find this airborne equipment the last word in precision, dependability and saving of weight and space:

20 or 40 channel 2-way VHF, R-15/T-20 or R-15/two T-20s
Course Director for use with 15-D, Type CD-1
VOR Localizer Receiver, Type 15-D
Powerful Cabin Speaker Amplifier, F-13A
Marker Beacon Receiver, R-20
Miniaturized ADF, Type 21

You will appreciate how each unit has been designed to operate as part of an integrated system – a complete and reliable communication-navigation installation. You will be pleased how its small size units make it fit easily into spaces forward and aft of the center of gravity . . . how it operates on the existing generator/battery system because of its low power consumption.

For your new twin aircraft we urge you to specify dual installations of the 20 or 40 channel 2-way VHF and of the VOR Localizer Receiver for IFR flying.

This dual equipment not only makes flying safer, but makes IFR operations so much more simple.

Ask your ARC dealer to quote you on all the above equipment. Ask him, or write us, for new condensed catalog of our entire line.

Miniaturized Automatic Direction Finders
Omni/Loc. Receivers • Course Directors • UHF and VHF Receivers and Transmitters • LF Receivers and Loop Direction Finders • 10-Channel Isolation Amplifiers • 8-Watt Audio Amplifiers • Interphone Amplifiers
Omnirange Signal Generators and Standard Course Checkers • 900-2100 Mc Signal Generators

Dependable Airborne Electronic Equipment Since 1928

ARC **Aircraft Radio Corporation** BOONTON, NEW JERSEY

Getting specific about gravity!

Falling apples fascinated Sir Isaac Newton. No doubt he enjoyed a few of them while devising his famous gravitational formulas. Newton's concern was with what came down, whereas aviation engineers today are primarily concerned with what goes up. Even so, the gravitational challenge is the same.

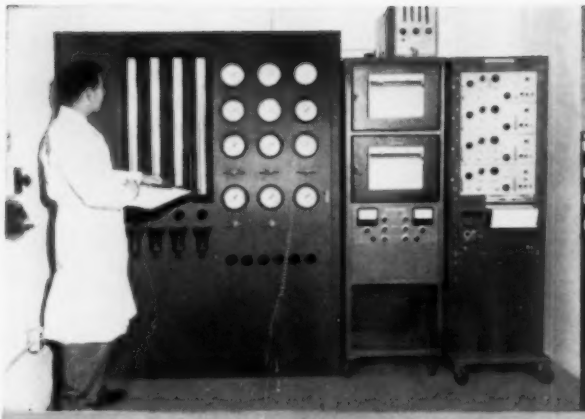
A jet plane, intercontinental missile—or anything that moves — usually leaves the design stage too heavy for optimum performance. To be specific — the specific gravity of the material of construction is too high.

Now, with Titanium, the design engineer can capture the strength of alloy steel at barely more than half the weight. What's more, Titanium is unaffected by most corrosives . . . and is impervious to the deadly attack of sea water and marine atmospheres. Its coefficient of expansion is low . . . and it can withstand long-time operating temperatures as high as 1000°F.

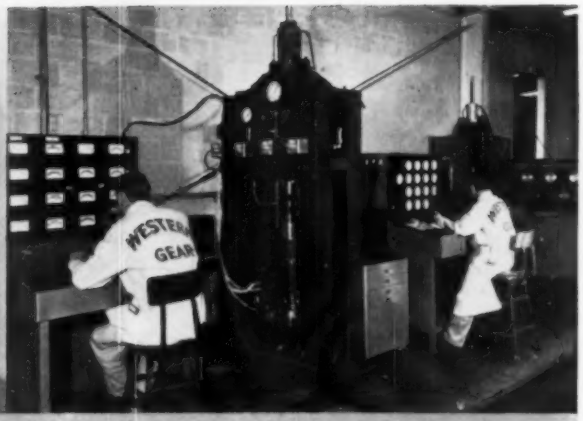
All types of Titanium mill products, from foil to seamless tubing, are made by TMCA. With production going up and prices going down, now is a good time to design with Titanium. Technical literature on Titanium is available just by asking.

. . . FIRST IN **Titanium**

TITANIUM METALS CORPORATION OF AMERICA, 233 Broadway, New York 7, N.Y.



Instrumentation for guided missile test cell



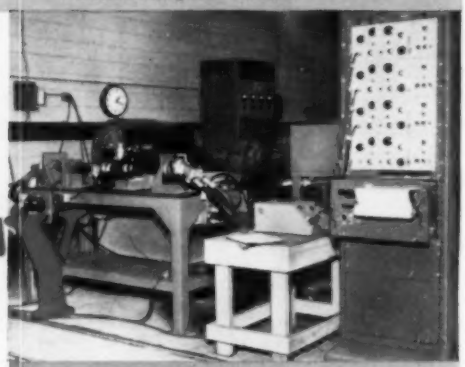
Production testing linear actuators

how WESTERN GEAR insures RELIABILITY

The equipment shown here is just a sampling of our investment to guarantee the aviation industry that the actuators, accessory drives, hoists, complete control systems, and other gear drives that carry the Western Gear name are as reliable as modern techniques can make them.

All product design, development and manufacturing efforts at Western Gear have *reliability* as their focal point. An investment of more than a million dollars in the most advanced testing equipment is matched by the careful, meticulous craftsmanship of Western Gear technicians. It is no accident that our slogan is *"The difference is reliability."*

Why not take advantage of the engineering assistance which we make available, without obligation, in solving your next design problem? Get in touch with us now. We'll place an application engineer at your immediate service! Address General Offices, Western Gear, P.O. Box 182, Lynwood, California. Phone NEvada 6-2161.



Special stand for "life" testing

Altitude test chamber

Guided missile test stand

"The difference is reliability" • *Since 1888*

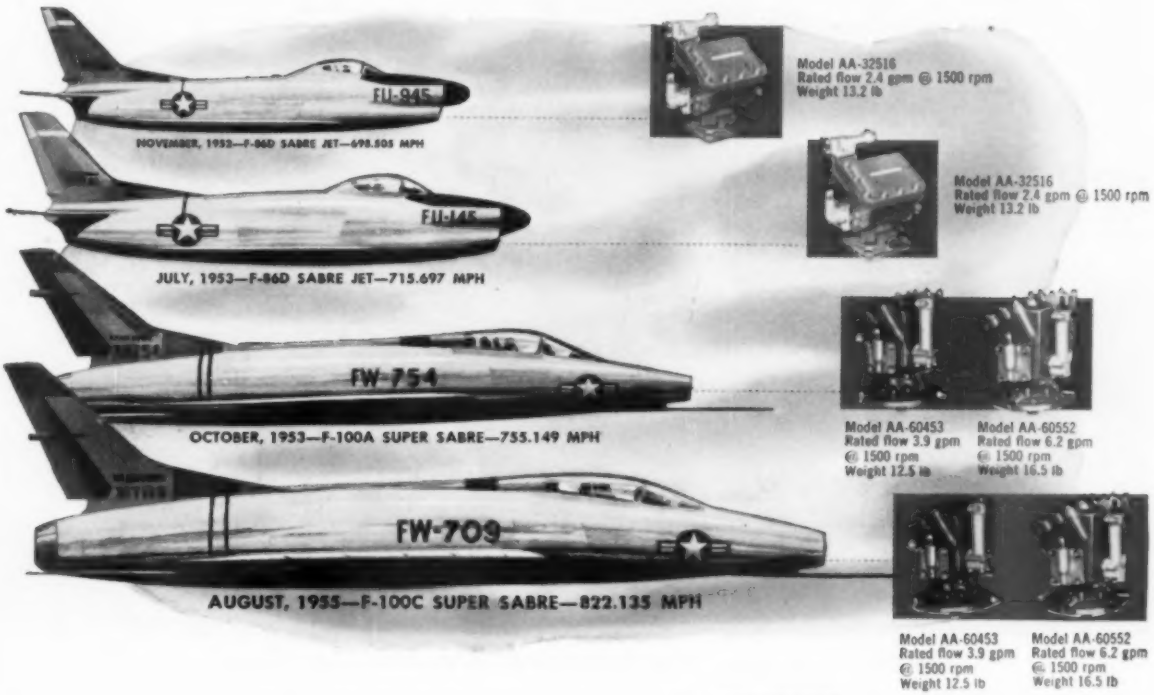
PLANTS AT LYNWOOD, PASADENA, BELMONT, SAN FRANCISCO (CALIF.), SEATTLE AND HOUSTON
REPRESENTATIVES IN PRINCIPAL CITIES

WESTERN GEAR Corporation
ENGINEERS AND MANUFACTURERS

WG

9433

WHERE *DEPENDABILITY* COUNTS MOST



NORTH AMERICAN SELECTED VICKERS® PUMPS*

FOR THIS HISTORY-MAKING GROUP OF FIGHTER AIRCRAFT

Shown at the right of the Sabre Jets and Super Sabres are the 3000 psi Vickers Pumps used in the powered flight control systems of these record-making aircraft. North American Aviation selected Vickers Variable Delivery Compensator Controlled Pumps. Because of their *outstanding dependability* and the other advantages they offer in the way of superior performance, Vickers Pumps have always been used for important assignments. Their technological advancement keeps pace with aircraft development. Significant benefits of these Vickers Pumps are minimum heat rejection, highest overall efficiency, small size and light weight. For additional information write for Bulletin No. A-5203-A.

* *3000 psi variable displacement piston type automatic pressure compensated*

VICKERS INCORPORATED
DIVISION OF SPERRY RAND CORPORATION
ADMINISTRATIVE and ENGINEERING CENTER
DEPARTMENT 1462 • DETROIT 32, MICHIGAN

7390

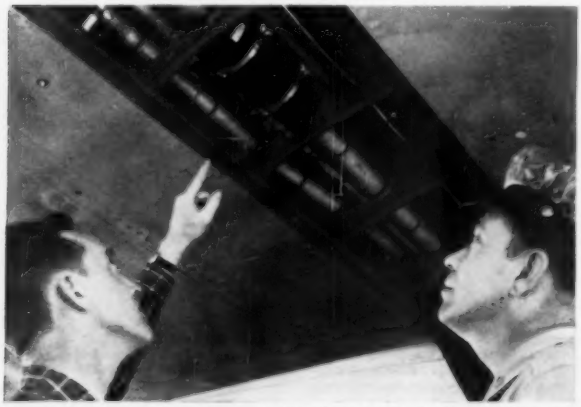
Application Engineering and Service Offices: **El Segundo, California, 2160 E. Imperial Highway • Detroit 32, Michigan, 1400 Oakman Blvd. (Service Only) Arlington, Texas, P. O. Box 213 • Washington 5, D.C., 624-7 Wyatt Bldg. •** ***Additional Service facilities at:*** **Miami Springs, Florida, 641 De Soto Drive**
TELEGRAMS: Vickers WUX Detroit • TELETYPE "ROY" 1149 • CABLE: Videt
OVERSEAS REPRESENTATIVE: The Sperry Gyroscope Co., Ltd.—Great West Road, Brentford, Middx., England

Boeing KB-50 carries out simultaneous refueling of three North American Super Sabres.

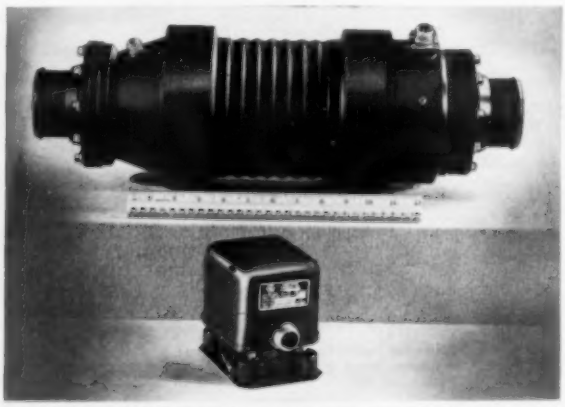
Fuel Flow Measured 50 Times Faster With New General Electric In-Flight Refueling Transmitter

Developed to help speed in-flight transfer of fuel from Air Force KB-50 and KC-135 flying tankers to bombers and fighters on long-range operations, the G-E In-Flight Refueling Transmitter is capable of measuring up to 10,000 pounds of fuel per minute as compared with the 200 pounds per minute performance of earlier models. The new transmitter unit, weighing only 17 pounds, is mounted in the fuel line leading to the line or boom which extends from the tanker plane during refueling. The transmitter complements its light weight with rugged construction to withstand the shock of peak flow surges including reverse flow—the sucking back of fuel when the refueling line or boom is retracted into the tanker. The flowmeter transmitter can operate at pressures up to 480 pounds per square inch, metering the fuel transferred with error of less than one per cent. Density compensation is not required, and the new flowmeter is insensitive to temperature and altitude changes.

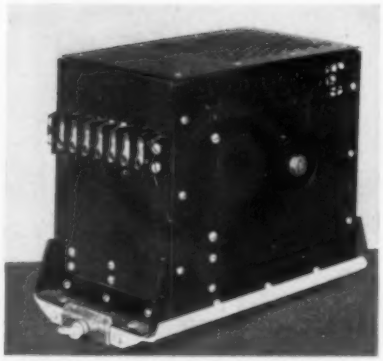
For more information on this or any other aircraft fuel control instruments call your nearest General Electric Apparatus Sales Office.



Mounted in each of the three refueling lines on the tanker, the General Electric in-flight refueling transmitter meters fuel to the receiving aircraft at pressures up to 480 pounds per square inch.



This lightweight G-E transmitter can measure up to 10,000 pounds of fuel per minute. One power supply provides a constant-frequency source from which all three transmitters are operated.



10 pound transformer-rectifier has expected life of 3500 hours at temperatures to 71 C.

General Electric, unregulated transformer-rectifier will give the Douglas DC-8 28-volt d-c power. Voltage fluctuation is limited to ±7.3 percent without additional regulation.

Lightweight, Unregulated Transformer-Rectifier for Douglas DC-8 Features Narrow Voltage Fluctuation

Four General Electric unregulated, airborne transformer-rectifiers, rated 35 amperes, 28 volts at full load, will furnish direct-current power for the new Douglas commercial jet airliners. The significant feature of the unregulated units is the minimum voltage fluctuation and one volt maximum peak ripple attained without reactors or other bulky regulation components. Within a load range of 0 to 25 amperes and 400-cycle input changes ranging from 195 to 202 volts line to line, the output voltage will remain within the limits of 25 to 29 volts. Maximum performance within these limits can be expected through 3500 hours of operation and at temperatures up to 71 C.

By using a transformer-rectifier, the new jet transport will have a reliable source of "on-the-spot" d-c power without the weight penalty of additional generating equipment and long bus runs. The G-E unregulated transformer-rectifier weighs less than ten pounds and contains no moving parts. The unit consists of a three-phase transformer and Vac-u-Sel* high temperature, selenium rectifier cells and contains a shunt for measuring output current. Each is convection cooled and has an expected life of 3500 hours when operated at 35-ampere loads; within the limits of 25 to 29 volts over any input or load condition up to 25 amperes the same life is expected.

For further information on General Electric airborne, transformer-rectifiers, both regulated and unregulated, contact your nearest G-E Apparatus Sales Office or check "A" on coupon below.

New 2PDT Subminiature Relay Gives Reliable Performance at 30 G Shock, Temperatures to 125 C

Latest addition to General Electric's line of hermetically sealed relays qualifies for severe-condition applications.

Built to give increased reliability to electronic equipment subjected to severe environmental conditions, the new General Electric 2PDT Subminiature relay withstands 30 G's shock with no contact opening in either energized or de-energized positions. The relay, rated 2 amps, is suitable for continuous operation in 125 C ambient temperature and is unaffected by vibrations of 10 to 55 cps at .12 inches total excursion or 55 to 500 cps at 15 G's acceleration. The operating advantages of this relay are further complemented by small size, .651 inches in diameter by 1.83 inches in length for the standard unit. The relay weighs approximately one ounce and is available in a wide variety of coil ratings.

Fatigue resistance is increased by heat treating the beryllium copper contact springs. The relay magnet is the conventional plunger type with provision made for adjusting the open gap position of the plunger after the relay is assembled in the can. Operating time with nominal voltage applied to the coil is approximately 10 milliseconds; drop-out time approximately 5 m illiseconds.

For more information on the 2PDT relay and other types of General Electric hermetically sealed relays, contact your nearest G-E Apparatus Sales Office. Check block "B" below for your free copy of the new 2PDT subminiature relay brochure.

*Trade-mark of the General Electric Co.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Mail to:
Section A210-104
General Electric Company
1 River Road
Schenectady, N. Y.

- ☐ "A" Airborne Transformer-Rectifiers Bulletin GEA-6443
- ☐ "B" New 2PDT Subminiature Relay Bulletin GEA-6412
- ☐ For immediate project
- ☐ For reference

Name_____

Company_____

Street_____

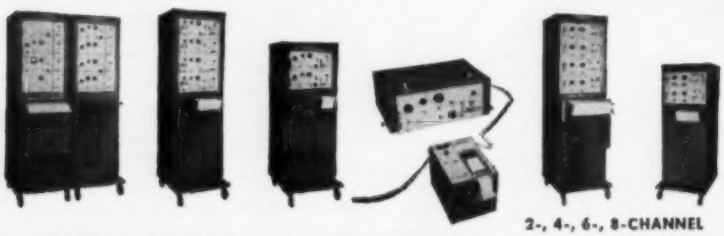
City_____ Zone_____ State_____

SIGHTS of rockets swooshing heavenward become more and more familiar as we thumb through today's industrial publications. The recalcitrant rocket shown on this page indicates that things *can* go wrong in research, and we don't claim that the absence of a Sanborn oscillographic recording system somewhere along the line was the reason for this disappointing trajectory.

What we do wish to say is that Sanborn equipment is playing an increasingly vital part in rocket development. Used in the laboratory to record flight behavior simulated by analog computers, and in plotting rooms at testing bases to tape down telemetered data, Sanborn "150's" are helping rockets to get and stay where they belong.

You can see Sanborn systems in many other places, too. Oil fields, electronic component production lines, machine tool plants, hydraulic testing laboratories, numerous aircraft manufacturers, computing facilities . . . are putting single to 8-channel Sanborn systems to work. (Most are housed in vertical mobile cabinets, while those in the "field" are often divided into portable packages for each instrument.) All of them give their users inkless, permanent recordings in true rectangular coordinates, one percent linearity, as many as nine chart speeds, and the efficiency (and economy) inherent in Sanborn unitized design. A dozen different plug-in preamps further extend their value, by making changeover to new recording inputs a quick and easy procedure.

SANBORN COMPANY
CAMBRIDGE 39, MASSACHUSETTS



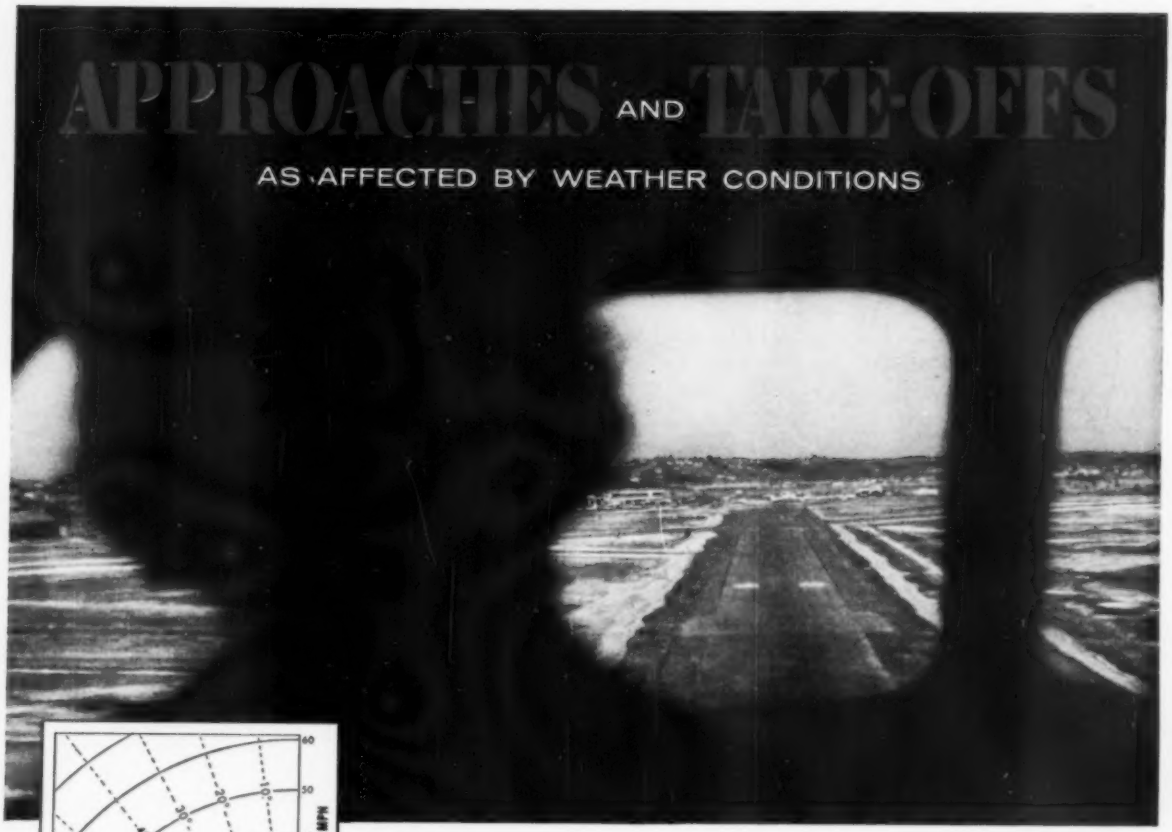
8-, 6-CHANNEL 4-CHANNEL 2-CHANNEL 1-CHANNEL 2-, 4-, 6-, 8-CHANNEL ANALOG COMPUTER SYSTEMS

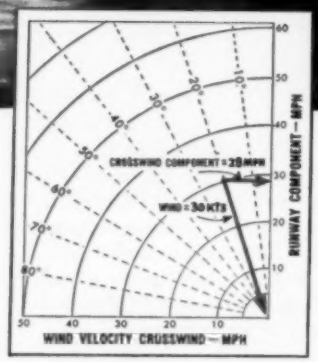
Which way rockets are going may not be a primary concern of yours. But if recording problems are, you're apt to find some interesting and useful answers in Sanborn's 16 page "150 System" catalog. Write to us for a copy.

FLY WEATHER-WISE

Mobil

These weather items prepared in consultation with the United States Weather Bureau





Crosswind Landings—Know the crosswind limitations of your aircraft. If you know the angle of wind to the runway, you can determine beam component following this diagram. (Example above)

Temperature, terrain, altitude, wind velocity and wind direction—all affect landing and take-off procedures.

When approaching an airport with thunderstorms in the vicinity, be on guard for sudden wind-shifts or downdrafts. Sudden reversal from headwind component to tailwind may cause you to lose altitude and undershoot. This condition is even more critical on take-off with heavy load.

Remember, at higher altitude fields, you will land faster because air is less dense. (Also remember your actual TAS is 2% faster than indicated for each 1000 ft. above sea level.) However, in maneuvering you are concerned with INDICATED air speed which is the same at altitude as at sea level.

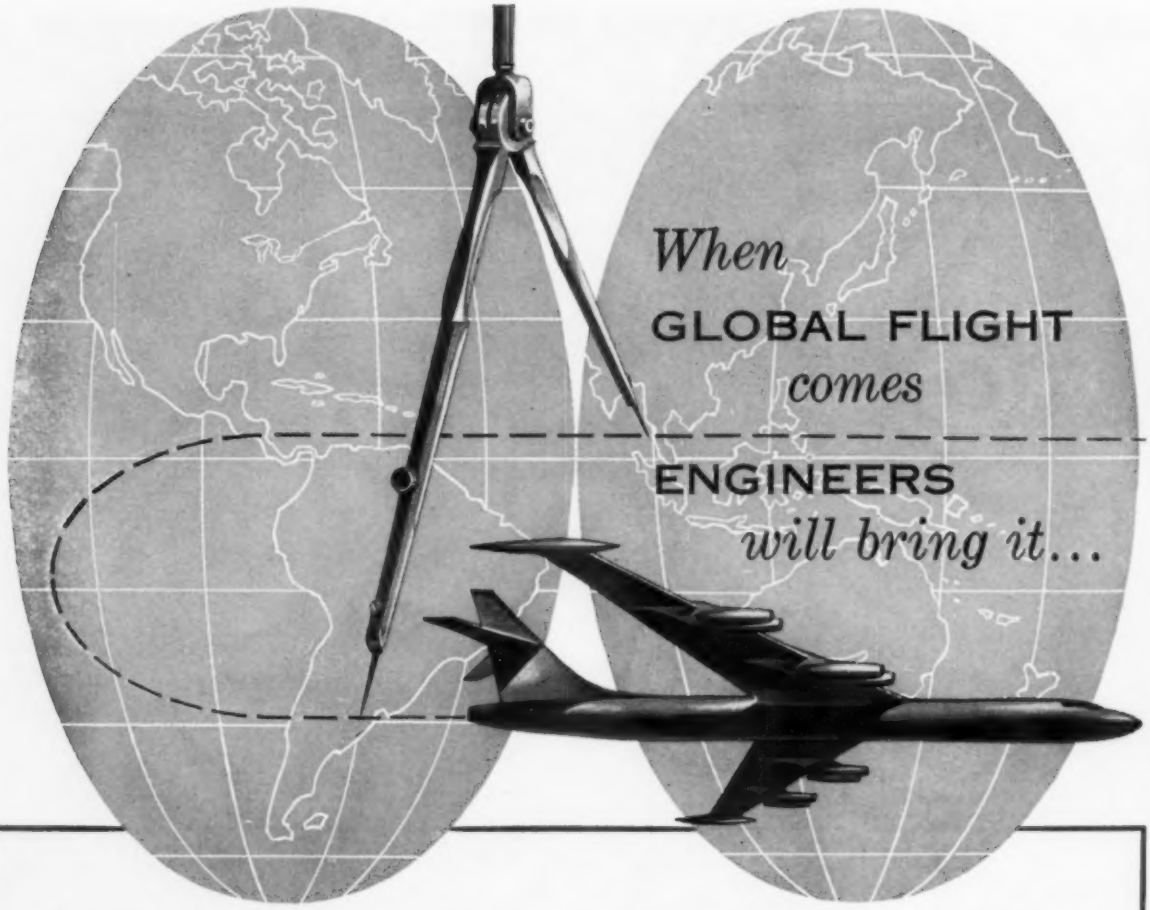
Effect of Terrain—Approaching over rocky terrain, plowed fields, paved roads in clear, hot weather, rising currents may cause you to overshoot. Descending currents over rivers, forests and wheat fields may have the opposite effect.

FORECAST: *Smoother landings with MOBIL AERO HYDRAULIC OILS*

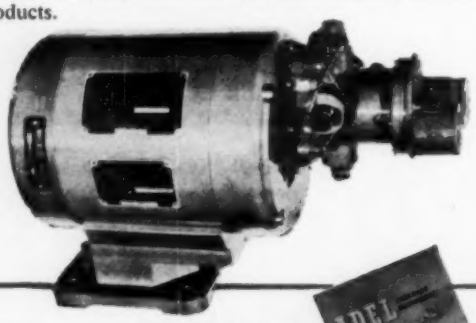
Smooth, shock-free landings covering wide temperature ranges are possible with top-quality Mobil Aero Hydraulic Oils. These mineral-base, extremely high viscosity index, low-pour oils have been specially developed to meet all aircraft hydraulic needs . . . are recommended and approved by leading manufacturers of hydraulic equipment. Good reason it *pays* to Specify Socony Mobil.

For Top Flight Performance—Make it **Mobil** *Leader in Lubrication for 90 years*

SOCONY MOBIL OIL COMPANY, INC., and Affiliates: MAGNOLIA PETROLEUM CO. GENERAL PETROLEUM CORP., MOBIL OVERSEAS OIL CO., INC.

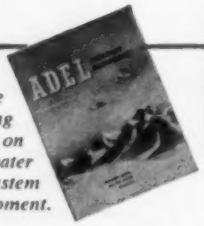


The fact that ADEL hydraulic & pneumatic control equipment; anti-icing, heater & fuel system equipment and engine accessories are in use by airplane and rotary wing aircraft all over the world today commends the *engineering* judgment that specified ADEL precision products.



In the *engineering* of rugged, reliable equipment for the aviation industry, *sky-high tests on the ground* is standard operational procedure in ADEL's modern laboratories. Environmental testing facilities simulate conditions of vibration, altitude, high and low temperature, relative humidity, fungus, sand and dust, explosion, etc. In-flight performance of ADEL precision products can be accurately predicted. It is *engineering* like this that assures unsurpassed equipment performance.

If it calls for CREATIVE ENGINEERING . . . ***call for ADEL!***



Write for descriptive Bulletin containing detailed data on Anti-Icing, Heater & Fuel System Equipment.

ADEL
PRECISION PRODUCTS
A DIVISION OF GENERAL METALS CORPORATION

BURBANK, CALIFORNIA · HUNTINGTON, WEST VIRGINIA
CANADA: RAILWAY & POWER ENGINEERING CORPORATION, LIMITED

ADEL designs and manufactures aircraft accessories in the following major categories:

HYDRAULIC & PNEUMATIC CONTROL EQUIPMENT

ANTI-ICING, HEATER & FUEL SYSTEM EQUIPMENT

ENGINE ACCESSORIES

LINE SUPPORTS

Douglas YC-124B powered by four 5550 h.p. Pratt & Whitney T-34 turboprop engines.

How the Holley "hidden co-pilot" does two jobs with one handle control

Throughout the entire operational range of the new Douglas YC-124B, engine power and propeller governor setting must be precisely coordinated. This has always been a "two-handle" job but in this new airplane the job is done with a single control lever and the help of a Holley Power Control which functions like a "hidden co-pilot".

One of these controls installed on each 5550 horsepower Pratt & Whitney Aircraft T-34 engines automatically senses altitude, air temperature and speed and feeds the information to its nerve center —a series of precision manufactured 3-dimensional cams. These cams continuously interpret this information in terms of engine power which is automatically adjusted through precise metering of fuel by the control.

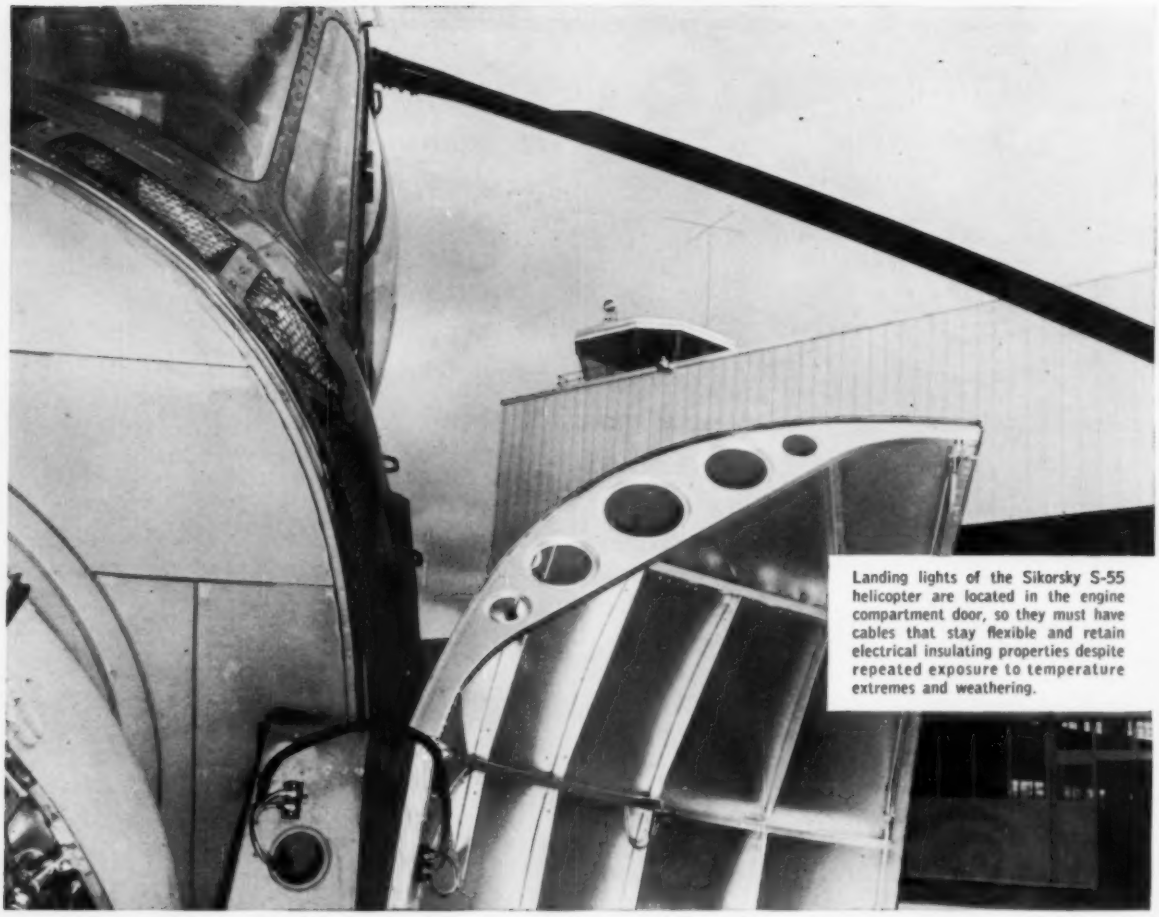
The Holley Power Control not only coordinates the engine and propeller for all forward thrust conditions but also controls the vital reversing of thrust necessary to reduce the aircraft's landing roll.

Designed, developed and manufactured by Holley, the "hidden co-pilot" is dependable, easy to service, compact and lightweight—four qualities that always distinguish Holley aviation equipment.

HOLLEY Carburetor Co.

11955 E. NINE MILE ROAD
VAN DYKE, MICHIGAN

LEADER IN THE DESIGN, DEVELOPMENT, AND MANUFACTURE OF AVIATION FUEL METERING DEVICES



Landing lights of the Sikorsky S-55 helicopter are located in the engine compartment door, so they must have cables that stay flexible and retain electrical insulating properties despite repeated exposure to temperature extremes and weathering.

SILASTIC covered cable resists heat, weathering

SILICONE RUBBER

Even after repeated exposure to temperatures as low as −130 F or as high as 500 F Silastic*, Dow Corning's silicone rubber, retains its flexibility, dielectric strength and resistance to ozone, weathering, moisture, certain hot oils and corrosive atmospheres. That's why Silastic, employed as a covering for all types of electric wire and cable, assures the ultimate in reliable service. Ask any leading rubber fabricator.

Get latest data on Silastic

Mail coupon today

Dow Corning Corporation, Dept. 0911b
Midland, Michigan

Please send me latest data on Silastic

NAME _____

COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

*T.M. REG. U.S. PAT OFF.

Typical Properties of Silastic for Wire and Cables

• Temperature range, °F	−130 to 500
• Tensile strength, psi	600 to 900
• Elongation, %	150 to 300
• Insulation Resistance, megohms/1000 ft.	1000 to 3000
• Dielectric strength	300 to 500
• Dielectric Constant, 10^2 cycles per second, nominal	3.2

If you consider ALL the properties of a silicone rubber, you'll specify SILASTIC.

first in silicones — DOW CORNING SILICONES

DOW CORNING CORPORATION • MIDLAND, MICHIGAN

...the standard transparent plastic for small planes, too...

The use of PLEXIGLAS acrylic plastic in aircraft is by no means confined to cockpit enclosures and windows on the country's fighters, bombers, helicopters and commercial transports. Manufacturers of planes for business and pleasure flying, like the makers of the Cessna 310 shown above, also use PLEXIGLAS—to give their customers unrestricted visibility and good service commensurate with the efficiency and comfort that are built into today's small aircraft.

PLEXIGLAS is the standard material for transparent enclosures because it has the required clarity, strength, light weight, formability and weather-resistance. Throughout the aviation industry, manufacturers count on the twenty-year experience of Rohm & Haas Company, as the supplier of PLEXIGLAS, for help in solving specific aircraft-glazing problems. They also can count on constant research at Rohm & Haas to raise the quality of transparent plastic to higher levels, to meet the requirements of planes of the future.

Chemicals for Industry

ROHM & HAAS COMPANY

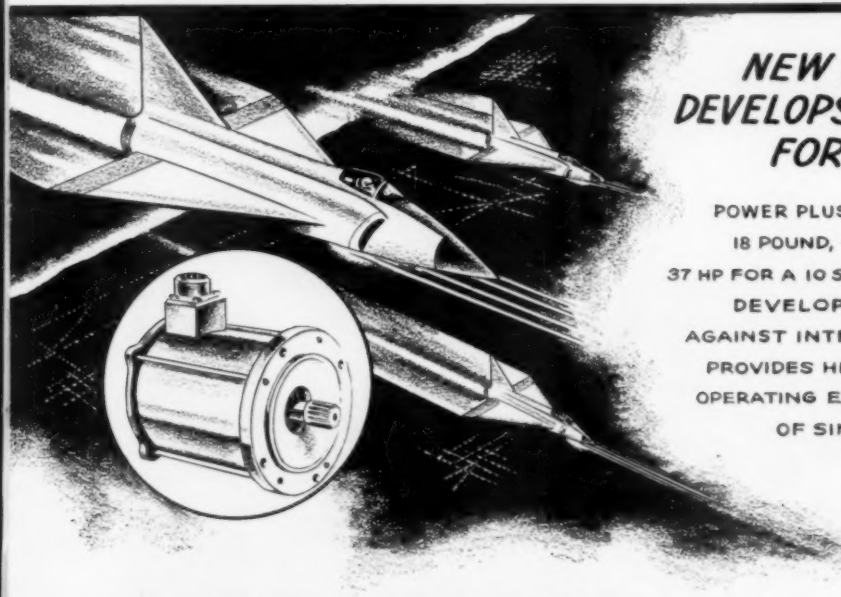
WASHINGTON SQUARE, PHILADELPHIA 5, PA.

Representatives in principal foreign countries

Canadian Distributor: *Crystal Glass & Plastics, Ltd., 130 Queen's Quay at Jarvis Street, Toronto, Canada.*

PLEXIGLAS is a trademark, Reg. U.S. Pat. Off. and in other principal countries in the Western Hemisphere.

AVIATION PROGRESS with G-E aircraft motors

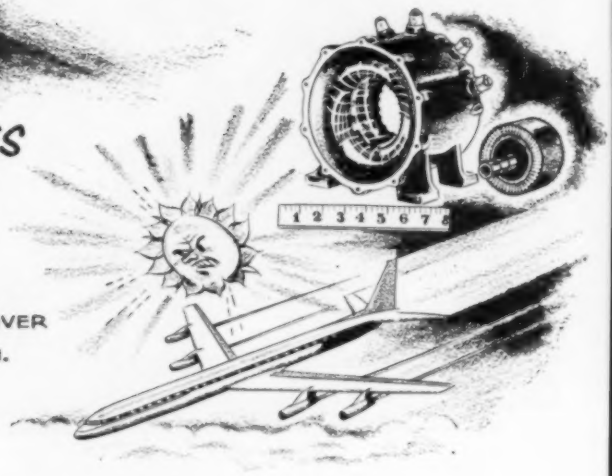


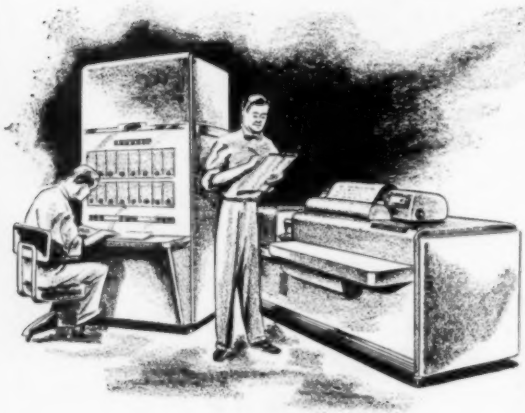
NEW G-E AIRCRAFT GUN MOTOR DEVELOPS **TWO HP PER POUND** FOR 10 SECONDS!

POWER PLUS HAS BEEN PACKED INTO THIS COMPACT 18 POUND, 400 CYCLE MOTOR WHICH DELIVERS 37 HP FOR A 10 SECOND FIRING INTERVAL. NEWLY DEVELOPED INSULATION SYSTEM PROTECTS AGAINST INTENSE HEAT. DOUBLE ROTOR DESIGN PROVIDES HIGH STARTING TORQUE AND EXCELLENT OPERATING EFFICIENCY – PERMITS UTILIZATION OF SINGLE OR DUAL POWER SOURCE.

G-E HERMETIC MOTOR PARTS LESS THAN 6½ INCHES IN DIAMETER DELIVER **25 HP CONTINUOUSLY** TO COOL AIRLINERS!

HERMETIC MOTOR PARTS WEIGHING ONLY 18 POUNDS DELIVER 25 HP CONTINUOUSLY AT A SPEED OF 23,500 RPM. TWO-POLE, 400-CYCLE POWER PACK CONSISTING OF STATOR, ROTOR AND SHELL IS DESIGNED TO POWER AIRBORNE COMPRESSOR.





DIGITAL COMPUTER DETERMINES BEST MOTOR DESIGN IN SECONDS!

DAYS OF CALCULATIONS BECOME SECONDS WHEN G-E AIRCRAFT MOTOR DESIGNERS PUT THIS COMPUTER TO WORK IN DETERMINING OPTIMUM MOTOR DESIGN IN THE FASTEST POSSIBLE TIME! AFTER PRELIMINARY DESIGN WORK HAS BEEN COMPLETED, COMPUTER CAN THEN BE INVALUABLE AID IN ASSURING BEST – AND FASTEST – POSSIBLE ANSWER TO YOUR MOTOR REQUIREMENTS.

THESE ARE ONLY A FEW EXAMPLES OF G.E.'S CONTINUING DESIGN LEADERSHIP. FOR HELP ON YOUR AIRCRAFT MOTOR PROBLEMS, CONTACT YOUR NEARBY G-E APPARATUS SALES OFFICE

GENERAL ELECTRIC CO., SECT. 634-5
SCHENECTADY, N.Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC

A Zenith Plastic Radome is a Vital Part of the TF-102A

Like its battle-ready counterpart, Convair's great F-102A supersonic fighter, the TF-102A two-place side by side trainer is also equipped with a Zenith radome.

An indispensable part of modern fighting aircraft, radomes are a highly specialized product, in the development of which the Zenith Plastics Company has long been a pioneer and leader.

In experience, equipment, mechanisms and men, the Zenith Plastics Company can render a service, in this highly sensitive and critical field, beyond that of any other source available to our Armed Forces and the aircraft industry.

ZENITH PLASTICS CO. *Subsidiary of* **Z** **gardena, calif.** *Minnesota Mining & Mfg. Co.*

BOEING's mighty B-52 and its new tanker sister, the KC-135, will add enormously to the Air Force's long-range power. These jet-powered giants use Hamilton Standard equipment. Years of aviation experience, the highest engineering skills and unsurpassed facilities lie behind the basic equipment produced by Hamilton Standard for turbine and piston-engined aircraft.

WHEREVER MAN FLIES

HAMILTON STANDARD

Propellers • Starters • Air Conditioning Systems • Fuel Controls • Valves • Pumps

HAMILTON STANDARD, WINDSOR LOCKS, CONNECTICUT

NOVEMBER 19, 1956

AVIATION WEEK

VOL. 65, NO. 21

Editorial Offices

New York 36—330 W. 42nd St., Phone LOngacre 4-3000 (Night LO 4-3035)
Washington 4, D. C.—National Press Bldg., Phones: NAtional 8-3414, REpublic 7-6630
Los Angeles 17—1125 West Sixth St., Phone: MAdison 6-9351

Coolidge Committee Criticizes Overclassification... 28
▶ Department of Defense told most leaks of classified information can be traced to its own mistakes.

ALPA Outlines Jet-Age Bargaining Plan..... 39
▶ Basic wage and rules program drafted by pilots' union at biennial convention in Chicago.

Successful British Rocket Motor Project Dumped... 52
▶ Throttleable rocket engine passed British flight clearance tests but was dropped by officialdom.

MISSILE ENGINEERING

French Missile Possibility..... 31
Regulus 1 on Submarine..... 33
Four Atlas Bases..... 34
Missiles at Aberporth..... 50
Fluorine Performance..... 55
Wing Tank Missile Guidance..... 63
New Missile Sub..... 129

AERONAUTICAL ENGINEERING

HR2S-1 Sets Three Records..... 29
UAC Tunnels to Hit Mach 10..... 31
Napier Tip Thrust..... 56
Rotor Icing Test Bed..... 59
New Ejection System..... 73
Rotodyne Loading..... 131

PRODUCTION ENGINEERING

P6M Crash Will Not Halt Production. 34
Electra Production Under Way..... 40
DC-8 Wings..... 64
Short Run Tooling..... 67
Boeing Leak Detector..... 107
Production Briefing..... 64

AVIONICS

ATC Beacon Codes..... 77
Computer Readout..... 78
Russian Instrument Controversy..... 85
Narco Omnigator..... 125
Expansions, Changes..... 91
Filter Center..... 92
New Avionic Products..... 95

EQUIPMENT

Viscounts Air Conditioning..... 104
New Hard Hat..... 107

TRANSPORT

DH 118 Plans Challenged..... 40
Freight-Rate Bid Dismissal Asked... 41
New Tourist Fare Sought..... 42
Tourist-Agent Relations..... 42
Brazilian Airline Equipment..... 43
Portable Heliport..... 45
Capital Orders Univac..... 49
Air Taxi Fleet in Florida..... 122
Airline Observer..... 47
Shortlines..... 47
Cockpit Viewpoint..... 49

BUSINESS FLYING

Cessna 172 Evaluation..... 115
Cessna Marketing Technique..... 121
Westland Helicopter..... 121
Private Lines..... 126

SAFETY

Vigorous AF Probe Urged..... 125
C-46 Crash Report..... 133

FINANCIAL

Airline Profits Increase..... 45
USAF Contracts..... 129

MANAGEMENT

Industry Observer..... 25
Who's Where..... 25
Defense Hides Information..... 30
Labor Organizes Committee..... 41
German Technical Committee..... 59
Convair Adds Three Schools..... 59
Washington Roundup..... 27
News Digest..... 36

Calendar..... 4
Letters..... 158

EDITORIAL

Need for an Airborne Army..... 23

COVER: Lockheed Aircraft Corp.'s Model 1649 airliner and 1049H convertible passenger/cargo airplane are new versions of Constellation basic design. Model 1649A is capable of non-stop flights up to 6,300 mi. It has new 150-ft. wing, carries 9,600 gal. of fuel and permits relocation of engines farther outboard to give more cabin quiet. Model 1049H can carry 20 tons of cargo or be converted to 92-passenger airliner. Model 1049H's 123-ft. wing has aspect ratio of 8.5 compared with aspect ratio of 12 for 1649A. Model 1649A wing also is one-sixth thinner. Company says bigger airplane cruises at 350 mph. with a top speed of near 400 mph.

Picture Credits:
29, 31, 34—Wide World.

PUBLISHER.....Robert W. Martin, Jr.
EDITOR.....Robert B. Hotz

MANAGING EDITOR.....Alpheus W. Jessup
ASST. MANAGING EDITOR (TECHNICAL) David A. Anderton
WASHINGTON.....Cecil Brownlow
NEW YORK.William Gregory, James J. Dailey, Robert I. Stanfield
LOS ANGELES.Irving Stone, Richard Sweeney
ENGINEERING.....Robert H. Cushman, Russell Hawkes
AVIONICS.....Philip J. Klass
CONGRESS.....Katherine Johnsen
MILITARY.....Claude O. Witze, Evert Clark
TRANSPORT....Craig Lewis, Glenn Garrison, L. L. Doty
EQUIPMENT.....G. L. Christian
BUSINESS FLYING.....Erwin J. Bulban
ART EDITOR.....Lawrence J. Herb
ASST. ART EDITOR.....Robert G. Young
EDITORIAL PRODUCTION.. Jerome E. Kelley
EDITORIAL ASSISTANTS Bernie Lang, Betty Hein
LIBRARIAN.....Jeanne Rabstejnek

FOREIGN NEWS SERVICE

EDITOR.....John Wilhelm
LONDON.....William J. Coughlin
PARIS.....Robert E. Farrell
BONN.....Gerald W. Schroder
MEXICO CITY.....John H. Kearny
RIO DE JANEIRO.....Peter Weaver
TOKYO.....Dan Kurzman

DOMESTIC NEWS BUREAUS

ATLANTA 3.....801 Rhodes-Haverty Bldg.
CHICAGO 11.....520 No. Michigan Ave.
CLEVELAND 15.....1510 Hanna Bldg.
DETROIT 26.....856 Penobscot Bldg.
HOUSTON 25.....1303 Prudential Bldg.
LOS ANGELES 17.....1125 West Sixth St.
SAN FRANCISCO 4.....68 Post St.
WASHINGTON 4...1189 National Press Bldg.

SALES

ADVERTISING SALES MANAGER E. P. Blanchard, Jr.
PROMOTION AND RESEARCH MANAGER W. H. Jack

ATLANTA.....R. H. Powell
BOSTON.....A. C. Boughton
CHICAGO and ST. LOUIS.....J. S. Costello, F. E. Bauman
CLEVELAND.....H. P. Johnson
DALLAS.....Gordon Jones, Douglas Billian
DETROIT.....C. A. Ransdell
LOS ANGELES.....C. F. McReynolds, D. T. Brennan
NEW YORK.....M. J. Storz
PHILADELPHIA....W. S. Hessey, J. D. Willis
SAN FRANCISCO.....William Woolston

BUSINESS

BUSINESS MANAGER.....J. G. Johnson
PRODUCTION MANAGER.....W. V. Cockren

RESEARCH AND MARKETING

Mary Whitney Fenton, Joan Read, Judith P. Wheeler

67,630 copies of this issue printed

AVIATION WEEK • NOVEMBER 19, 1956 • Vol. 65, No. 21
Member ABP and ABC

B.F.Goodrich

When the pressure's on, it flies anywhere

IN performing thousands of dramatic air-sea rescues, the Grumman Albatross has always relied on B. F. Goodrich De-Icers. Now a redesigned model of the Air Rescue Service amphibian is in production. For this new Albatross, the choice is the latest in ice protection —BFG small tube *chordwise* De-Icers.

Small rubber tubes that inflate and deflate to snap off ice are built in line with the air stream. This improved tube arrangement smooths the flow of air over the wings during the brief inflation period. Regardless of icing conditions, critical sea landings and take-offs can be made safely.

The four De-Icer sections on each wing of the Albatross are automatically cycled. They inflate in succession outboard from the nacelles, in symmetrical pairs. At no time during the cycle is more than one pair inflated. Pilots can choose between fast and slow operation.

From the pilot's viewpoint, this adds up to a method of ice removal unequaled in simplicity by any other system. When ice is encountered, he merely flicks a switch—and B. F. Goodrich De-Icers go into positive, visible action.

B. F. Goodrich has De-Icers to solve any icing problem. Why not let our engineers help you? They've been solving tough icing problems for 26 years. *B.F.Goodrich Aviation Products, a division of The B.F.Goodrich Company, Akron, Ohio.*

B.F.Goodrich

Tires, wheels, brakes • De-Icers • Inflatable seals • Fuel cells • Avtrim • Heated Rubber • Pressure Sealing Zippers • Rivnuts • Plastilock adhesives • Hose and rubber accessories

EDITORIAL

Need for an Airborne Army

The twin crises of Suez and Hungary demonstrated again the vital need for airborne armies. The joint Anglo-French assault against the Suez Canal was thwarted in large measure because of the limited airborne operation that could be mounted from Cyprus. Since the Anglo-French assault depended for success upon a seaborne invasion from both ends of the Suez Canal, it was effectively frustrated, and the Allies were left in an untenable political position and dubious military status.

Informed Britons have been pointing to the almost total lack of air mobility for its land forces for more than five years. The Royal Air Force Transport Command has been a sickly stepchild in the British military family, equipped largely with second-rate piston engined transports—and not even enough of these to mount an airlift of any significance. Nor do these old fashioned military transports have flooring, doors or a loading level required for any heavy equipment such as artillery, vehicles and tanks. Even to move sufficient troops to the Cyprus base, the Royal Air Force had to hastily press into service Britannia turboprop transports which can swiftly carry large quantities of riflemen over long distances, but little else in the way of military equipment.

Russians Recognize Weakness

The French airborne capability is even less than that of the British. So, instead of a swift vertical envelopment—first seizing airheads all along the canal from Port Said to Tewfik and then pouring in reinforcements, tanks, artillery and other supplies by air transport—the Anglo-French effort was limited to a single airborne assault of limited strength at one end of the canal.

It is also significant that, when the Russians decided to crush the Hungarian revolt against Communist rule, their first concern was to ring the main airfield at Budapest with tanks in an attempt to counter any possible military support for the Hungarians from western nations. That no such support was forthcoming does not alter the fact that the Russian military leaders recognized that the only way it could arrive in time to be effective was by air. They moved to counter this possibility even before they moved into the city to crush the Hungarians in as brutal a blood bath as a world supposedly at peace has ever seen.

During the post-war years, the U.S. Air Force and Army have been moving in the direction of a truly effective airborne army. They have come a long way from the relatively crude airborne assaults of World War II from C-47s and C-46s, but they are still a long way from having a truly effective airborne army. Dr. Edward Teller, scientific catalyst of the hydrogen bomb development, recently pointed out the significance of an airborne army, relatively small in size but equipped with a variety of small nuclear weapons now available in this modern, crisis-ridden world (AW Nov. 5, p. 32). A force of this nature could function efficiently as an international fire brigade to extinguish local wars such as the Israel-Egypt conflict in time to prevent their spreading to the proportions of the current world-wide crisis, where any uncalculated hair-trigger move can touch off an atomic world war, unleashing weapons of mass destruction.

Air Force Capability

The Air Force has a family of modern transports well advanced in development that will be capable of moving ground troops and a wide variety of their equipment. In the assault transport category, the Stroukoff-designed, Fairchild-manufactured C-123 is in service and has indicated its efficiency in field operations. Coming along behind this assault transport is the Lockheed C-130, a medium range military transport using turboprop power for a combination of speed, short field performance and heavy-load-carrying capacity. The Lockheed Hercules is in production at the Marietta, Ga., plant and should be in service with the Tactical Air Command soon.

A prototype of the heavyweight in this new family of military transports is in the early stages of flight testing. It is the Douglas C-133, powered by four 6,000 eshp. turboprops and capable of carrying 50,000-lb. payloads nonstop across the Atlantic. The C-133 will go into production at Douglas' Long Beach, Calif., plant. An ultra heavy transport designed for global logistics is the Douglas C-132, which is still some time away from its first flight. This aircraft will carry 100,000-lb. payloads over the Atlantic nonstop.

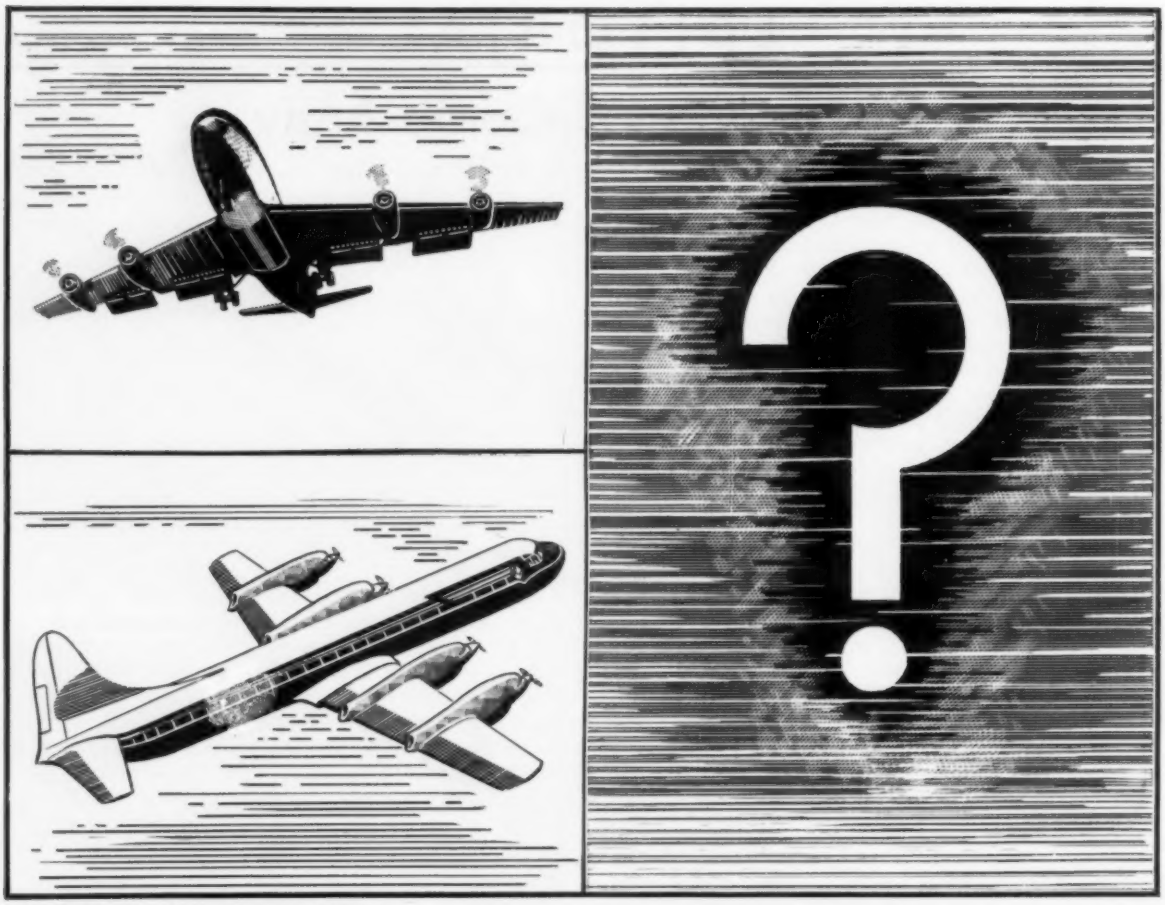
This is a family of transports that will give both USAF and the Army the swift mobility required in the modern world where a brush-fire war may erupt along almost any part of the globe. Their development should be pushed hard and not shoved far down the priority scale because of a mistaken conception that military power can be used effectively without modern air transport.

Task of the Army

The Army also has been doing research and development on redesigning all its basic equipment to make it air transportable. We are glad to see that this program has been pushed harder since the advent of Gen. Maxwell Taylor as Army Chief of Staff. It, too, is a vital ingredient of an effective airborne army. The Army still has a long way to go to get a truly air transportable division equipped with mobile nuclear weapons, but it must press relentlessly toward that goal if it is to continue to be a vital part of our military posture.

In creating an effective airborne fire brigade, USAF and the Army must work closely and harmoniously together. Neither service can do the job by itself. Although there are now many areas where new technology has created areas of genuine interservice rivalry over roles and missions, it would be tragic if the creation of a type of airborne police force that is so desperately needed in the world today was hamstrung and delayed by interservice bickering.

—Robert Hotz



Top: BOEING "707" Bottom: LOCKHEED "ELECTRA"

who'll be next to use PNEUMATICS?

The new Boeing "707" and the new Lockheed "Electra" are both equipped with Kidde compressor-powered pneumatic systems. The reliability of Kidde designed and manufactured equipment, proved by thousands of systems in military aircraft, made Kidde pneumatics a natural choice of these forward looking manufacturers. Who will be next?

Designers and developers of lightweight, dependable pneumatic actuating systems, Kidde's creative engineering staff has refined pneumatics to an amazingly flexible state. Today, there is no job—aloft or on the ground—which pneumatics cannot do as well *or better* than existing aircraft actuating systems.

In addition to 4cfm and 2cfm compressors which are currently in production, Kidde also has a complete line of allied pneumatic equipment—pressure relief valves, dehydration equipment, lightweight steel or fiberglass high-pressure storage vessels. 6cfm, 8cfm, 12cfm and 25cfm compressors, some developing 5000 psi, are now in various stages nearing production.

At this moment, Kidde can furnish many items of pneumatic equipment on an off-the-shelf basis, and can furnish as well the engineering talent to develop special equipment on request. Consider the use of pneumatics in today's, or tomorrow's, aircraft. Why not discuss your pneumatic problems with Kidde?

Kidde

Walter Kidde & Company, Inc.
1118 Main St., Belleville 9, New Jersey
Walter Kidde & Company of Canada Ltd., Montreal

District Sales-Engineering Offices: Washington, D. C.; Dayton, Ohio; Dallas, Tex.; Seattle, Wash.; St. Louis, Mo.; Van Nuys, Calif.; Montreal, Canada; Belleville, N. J.

WHO'S WHERE

In the Front Office

Francis M. Banks, president and general manager of Southern California Gas Company, a director, Servomechanisms, Inc., New York, N. Y.

Albert S. Hovannesian, president and treasurer, Diamond Antenna & Microwave Corp., Wakefield, Mass.

L. Eugene Root, vice president and general manager-Missile Systems division, Lockheed Aircraft Corp., Van Nuys, Calif.

Phillip T. Drotning, vice president-public relations, Northwest Orient Airlines.

Richard W. Walker, vice president-manufacturing, Transitron, Inc., Manchester, N. Y.

Joseph F. Gleason, vice president, Adams Aircraft Engineering Co., Inc., Windsor Locks, Conn.

Honors and Elections

Ray O. Mertes, director of the School and College Service Department of United Air Lines, has been named the winner of the 1956 Frank G. Brewer Trophy, the nation's highest award in the field of youth aviation education and training.

Rex Brack, vice president-traffic and sales of Braniff Airways, has been elected president of the Air Traffic Conference for 1957.

H. E. Moore, quality control manager for McDonnell Aircraft Corp., has been elected national chairman for 1957 of the Aircraft Industries Association Quality Control Committee.

John F. Harris, manager of components and standards engineering for Westinghouse Air Arm Division (Baltimore), has been elected national chairman for 1957 of the AIA Electronic Equipment Committee.

Changes

Roy L. Stewart, Jr., manager-evaluation, Technical Military Planning Operation, General Electric Co., Santa Barbara, Calif.

Warren E. Milner, manager-Milwaukee plants, AC Spark Plug Division, General Motors Corp., Flint, Mich.

Allan K. North, sales engineer heading Adel's newly established Toronto, Canada office, Adel Precision Products, Division of General Metals Corp., Burbank, Calif.

James Montgomery, director-sales development, Pan American World Airways.

Bert G. Maynard, chief engineer, Republic Aviation International, Lugano, Switzerland.

J. C. Elms, department manager-Armament Control; **D. L. Williams**, department manager-Flight Control; **D. B. Wright**, department manager-Flight Test; **S. F. Evestone**, department manager-Guidance; **E. A. Holmes, III**, department manager-Reliability and Standards; and **G. D. Shere**, department manager-Data Processing Equipment, Autonetics Division, North American Aviation, Inc., Downey, Calif.

John K. Brown, public relations officer of newly established public relations office, de Havilland Engine Co. Ltd., Hertfordshire, England.

INDUSTRY OBSERVER

► First firing of an experimental prototype of the Douglas Thor intermediate range ballistic missile will be made before the year's end from the USAF Missile Test Center at Cape Canaveral, Fla. Prototype already has been delivered to Patrick (AW Nov. 5, p. 23).

► North American Aviation Inc. has fired a G-26 configuration of its Navaho intercontinental cruise missile development to a range of 2,000 miles from the USAF Missile Test Center. The G-26 configuration features a pair of ramjet powerplants for high supersonic cruise performance plus rocket boosters to get the ramjets up to operating speed. This configuration also has a V-shaped tail.

► Hardware for a Navaho-sized ramjet engine is being produced in small quantities by two firms for Curtiss-Wright Corp. Nozzle liners are being manufactured by T. R. Finn Co., Hawthorne, N. J. Lycoming Division of Avco Manufacturing Corp. in Stratford, Conn., is fabricating a nozzle housing. Housing size is 48 in. in diameter, which means a net thrust of 30,000 to 40,000 lbs., or between 60,000 and 80,000 lbs. if used on a dual-ramjet Navaho.

► USSR is currently evaluating three competing designs of slow-flying artillery spotting and reconnaissance aircraft by Antonov, Yakovlev and Shukoi. Antonov's entry is a development of his AN-2 Colt biplane, with a twin-tail assembly replacing the single tail. A tail turret with a single 23-mm. cannon is installed.

► Navy will order approximately 70 RP-70 rocket-powered target drones from Radioplane Co. for evaluation purposes. First of the drones, which can reach Mach 0.9 and 50,000 ft., already has been delivered and probably will be tested next month at Point Mugu, Calif.

► Army is pushing its tactical airlift efforts with research on how to supply field forces by plane and helicopter while maintaining almost complete radio silence. Three programs have been conducted at the Civil Aeronautics Administration's Technical Development Center in Indianapolis.

► A West Coast firm is designing and developing large liquid-oxygen manufacturing facilities for Glenn L. Martin's intercontinental ballistic missile plant in Denver and for Patrick AFB. The plants will be comparable in size to some of the largest liquid-oxygen facilities now in existence.

► Antonov AN-10 70-passenger turboprop transport is almost ready to begin ground runs at its factory in Kiev. The aircraft is a high-wing configuration and is powered by four 4,000 eshp. engines. Russians hope to demonstrate the transport at the French Salon de l'Aeronautique at Le Bourget next May.

► Army Transportation Corps, responsible for aviation maintenance, is seeking better ways of inspecting bonded joints in metal helicopter rotor blades. Proof loading and ultrasonic techniques are being studied under the Transportation Corps' sponsorship at CAA's Technical Development Center in Indianapolis.

► Civil Aeronautics Administration has placed $9 million order for 23 long-range radars with Raytheon Manufacturing Co. in first step toward implementing its long-range plan to provide en route traffic control radar coverage. Initial delivery will begin next summer. The 23 Raytheon radars, together with five air defense sets, will provide continuous coverage of the Chicago-Boston-Norfolk triangle plus coverage of the high traffic airways around the country. Radars will have dual equipments to assure uninterrupted service, and circular polarization to minimize precipitation clutter.

► L. B. Smith Aircraft Corp., of Miami, will install special executive interiors in three Vickers Viscount turboprop transports for U. S. Steel. Interiors were designed by Charles Butler Associates of New York.

Braniff International Airways' "El Dorado" DC-7C's—first planes to carry the new Bendix ADF equipment— are operating non-stop on the Company's Texas–New York and Texas–Chicago runs.

Howard Droggers, Director of Communications, Braniff International Airways, checks receiver of a Bendix DFA-70 Automatic Direction Finder System mounted in a Braniff "El Dorado." The Bendix DFA-70 is a fully automatic direction finder that provides to pilots visual and aural identification of radio aids to air navigation.

GENERAL ELECTRIC 5-STAR TUBES HELP BENDIX PROVIDE A SURE, SAFE ADF SYSTEM!

Bendix Aviation Corporation —a leader for 25 years in the development of electronic devices for air navigation—uses General Electric 5-Star Tubes of four different types in its newest equipment, the DFA-70 Automatic Direction Finder System.

Increasingly heavy traffic on the airlanes demands extra dependability from navigation gear; every component must do its job. The 5-Star high-reliability tubes which are used in the DFA-70 contribute much to the trustworthiness of Bendix' new system.

5-Star Tubes are tailor-made for critical airborne applications. With special sturdy design, they resist the shocks and vibration met in flight. Extreme care in manufacture and exhaustive test procedures safeguard electrical stability and make for full, efficient tube life.

Ruggedness . . . reliable electrical performance . . . long life: these 5-Star characteristics that Bendix values are available to you. For full information on 5-Star Tubes—their many applications, their numerous advantages—write *Electronic Components Division, General Electric Company, Schenectady 5, New York.*

Progress Is Our Most Important Product

GENERAL ELECTRIC

162-105

Washington Roundup

Nuclear-Plane Stretchout

Now that the election is past, look for increasing discussion of the Fiscal 1958 Defense Department budget. The world crisis and interservice rivalries lend more urgency to the annual Pentagon hassle over money. One of the first definite facts to come to light: USAF's nuclear propulsion projects will be slowed down below the development rate established in the original schedule.

This does not mean that budget considerations are paramount in the decision, but they are important. Says one industry observer: "This is not an issue with two sides, there are three or four."

Officially, USAF spokesmen who reflect the viewpoint of the Pentagon's budget-conscious political administration say the Aircraft Nuclear Propulsion stretchout is due to an over-optimistic schedule seeking "early operational capability." They add: "Despite significant advances that have been made there are remaining technical problems in the propulsion system which must of necessity pace this development."

Both industry and military research and development officials are inclined to resent the implication that a development bottleneck is responsible for the slowdown. With enough money, they say, the original schedule can be maintained, and "the program follows the dollars."

It also appears that USAF's top decision makers have some doubts about whether the nuclear bomber schedule is worth the cost. As a practical matter, the aircraft will have one outstanding advantage: unlimited range. In order to get it, a lot of things are needed in addition to perfection of the propulsion system. These include special bases, training programs, safety measures and a bulky airframe that is easier to detect than more conventional aircraft. In addition, the weapon system is dangerous.

In view of these facts, the Air Staff has passed judgment: the project will be continued at an orderly rate but not to the point where its demand for dollars could jeopardize other important projects. In short, they feel there is a point of diminishing returns beyond which the flow of funds should not be increased, particularly if this jeopardizes another project promising good results, quicker and cheaper.

It is obvious that the chemical bomber is one of these other projects.

Long Life for Moss Committee?

Continued Democratic control of Congress assures the continuance of the House Information Subcommittee well into 1957. The subcommittee, headed by Rep. John E. Moss (D.-Calif.), plans to issue a second interim report after it completes hearings on defense department information and secrecy policies (see page 30), then ask for a new lease on life.

Next year it would like to:

- **Work on legislation aimed at** cutting through the "paper curtain" it has found surrounding government information.
- **Serve as a watchdog committee** before which official efforts to hamper free flow of information could be aired. Without such a group, there is no appeal from departmental decisions, no official body attempting constantly to counteract the growing trend toward more secrecy, especially in military-scientific fields.
- **Complete its task of studying information** policies of major government agencies, including the State and Justice Departments and possibly the Atomic Energy Commission.

Middle East and Defense Spending

Middle East crisis, which probably will get worse before it gets better, will result in more Defense Department spending—but not in the field of aircraft industry hardware. The affair that Defense Secretary Charles E. Wilson first looked upon as a "ripple" has grown to the point where his early estimates for military manpower and operational expense are headed upward. The next few weeks will decide how high they must go. Where possible, some procurement schedules may be speeded up but don't count on any important change in total air strength. Biggest argument again will be over a basic question: how much for research and development?

Manpower Study

Watch for the report by the Defense Department's Cordiner Committee to come out in about two weeks. There is a possibility that it will make a recommendation that more Defense maintenance and repair work be done by private industry. In addition, there will be some consideration of the technique of demanding industry warranties on military equipment. Third major area covered will be that of changes in specifications that will speed training programs and ease maintenance. Overall aim of the committee is to find solutions to the Armed Forces manpower problem in the area of skilled personnel.

Jet Safety Tour

The Civil Aeronautics Board will make a flying trip to the West Coast next week for a first-hand view of turbine transport developments. The five Board members and a group of staff officials plan to visit manufacturers now designing and building jet transports to gather background for the decisions the CAB must make in preparing new jet safety and economic regulations.

The tour will start with Boeing in Seattle on Nov. 29. The CAB visitors will discuss the safety, economic and operational developments of turbine transports in general and the 707 in particular. The discussions will be followed by a flight demonstration of the 707 similar to the flights taken by Civil Aeronautics Administration officials last month. From Seattle, the group will go to Los Angeles for similar briefings from Douglas on the DC-8 and from Lockheed on the Electra, and then to San Diego for discussions with Convair on the 880. After returning to Washington, the CAB will meet with Fairchild on the F-27.

In an effort to prepare itself for the decisions it must make on Draft Release 56-20 and other turbine transport regulations, the Board originally planned to invite the five manufacturers to Washington for discussions, and negotiations were started early last month by the Bureau of Safety Regulation.

Then the manufacturers decided to invite the CAB to come to the West Coast, saving the time of engineers who have to travel to Washington and giving the Board a first-hand view of developments with which they will have to deal.

—Washington staff

Rivalry, Secrecy Blamed for 'Leaks'

Industry, military and press blamed by Coolidge committee; overclassification condemned.

By Claude Witze

Washington—Department of Defense was told last week that most "leaks" of classified information can be traced to its own mistakes—overclassification and interservice rivalry.

The report by a committee headed by Charles A. Coolidge, former Assistant Secretary of Defense, was critical of uniformed service personnel, defense industries and the press as well as the inherent weaknesses in application of the security system.

The committee was appointed by Defense Secretary Charles E. Wilson in August and charged with the task of drafting recommendations to help protect classified material by stopping "leaks" to the public.

At the same time, it found no important flaw in the Pentagon's civilian administration over information matters. That aspect of the problem was being investigated on Capitol Hill by Rep. John E. Moss (D.-Calif.) and his subcommittee on information (see page 30).

The Coolidge committee report suggested penalties for persons who violate confidences and menace national security by disclosing classified information.

Industry violators, it said, should be threatened with loss of their clearance and "diversion of future business." News reporters, the report said, should be subject to summons before a grand jury to testify on the source of their information.

For guilty members of the Defense Department, it urged "stern disciplinary action." And this action should be extended, the committee said, to any individual who "has not accepted a decision reached by the Secretary of Defense or higher authority."

The committee cleared the Defense Department of any effort to withhold information that is not classified and said the present classification system is sound, but not operating as well as it should be.

Major Recommendations

Major recommendations of the committee include:

- **Reduction in the amount** of classified material, both old and new, and insistence that classification be used only on items vital to national security.
- **Reduction in the number** of persons authorized to classify information and a requirement that superiors reject overclassified material received from subordinates.
- **End to classification of** information that cannot be kept secret. This would apply to aircraft after they are rolled out into public view.
- **Release of more information** on arguments between the services, permitting them to debate issues in public without disclosing military secrets.
- **Establishment of a declassification** program to clear the files of material no longer critical to national security.
- **Prompt and vigorous** investigation of "leaks."
- **Use of the "For Official Use Only"** classification to protect information on official matters of department business.

Security Threatened

The committee said national security sometimes is threatened by disclosure of information given to Congress. It acknowledged that this data is essential for the legislators to act on appropriation bills. At the same time, it recommended that care be exercised to make sure none of the information appears in published proceedings.

All Appropriation Committee hearings are edited by the Defense Department's Security Review Branch before they are published.

Blunt Rejection

At least two ideas once favored by the administration are rejected bluntly in the Coolidge report.

One of them is the concept that security is endangered by compilations of unclassified data already made public. The committee says these may help a potential enemy but only by saving him time and effort.

A second proposal—that voluntary censorship by the press should be organized—was turned down as a program that should be used only in times of war.

Both of these suggestions were promoted with some vigor by R. Karl Honaman while he served as Assistant Secretary of Defense for Legislative and Public Affairs. He brought them to the Pentagon from the Department of Commerce where he had headed the Office of Strategic Information.

Erwin Seago, present OSI director, is on the record as favoring a curb on publication of unclassified information.

Technical Media

In giving special attention to trade and technical journals, the committee separated these papers from the "press"—which it defined as non-technical news media. It recommended that "press" interviews with Defense personnel in the Washington area be arranged only through the Office of Public Information. Another suggestion is that, when an item is denied to the "press," the reason should be made clear why it is classified.

As for the trade and technical papers, these publications, the committee says, obtain classified information from Defense Department contractors. Mentioned specifically are "visits to manufacturing plants and conversations with manufacturer's personnel."

Existing rules of the Industrial Security Manual, however, already forbid contractors to give such data to the trade press. In addition, stories resulting from authorized plant visitations are required to pass through the Defense Department's Security Review Branch for clearance.

The Coolidge report recommends that "strengthening amendments" be added to the Industrial Security Man-

How Wilson Views Coolidge Report

Washington—Defense Secretary Charles E. Wilson has ordered immediate action to carry out recommendations of the Coolidge Committee, but he has "serious reservations" about some of its ideas on how to protect classified information.

Wilson appointed Mansfield D. Sprague, general counsel of the Defense Department, as chairman of a committee to review the Coolidge recommendations and to prepare directives to carry them out. Other members are Carter L. Burgess, Assistant Secretary for Manpower, and Robert Tripp Ross, Assistant Secretary for Legislative and Public Affairs.

Wilson said in a note to Coolidge that he expects an improvement in procedures "for keeping the Congress and the public fully informed."

The Secretary added that he has reservations about a few of the recommendations, particularly the ones urging that reporters be summoned to appear before grand juries and that the press be briefed on the difference between peace and cold war.

French Light Interceptor

Light interceptor built by France's Ouest Aviation to a design of the Office Nationale d'Etudes et de Recherches Aeronautiques is in flight test at the French air force test center at Bretingny near Paris. Plane, Deltaviex, has 70 deg. swept-back wings, weighs about 2,025 lb., has a wingspan of 11 ft. 2 in. Powerplant has an 880-lb. thrust, is presumably a Turbomeca Marbore 2. Supercirculation is used for high lift coefficients at landing. Horizontal tail is aerodynamically horn-balanced, has large elevator and small stabilizer. Vertical tail in dorsal position is conventional; ventral surface also has rudder for control at high angles of attack which normally blanket dorsal rudder. Cylindrical housing at rudder base may be rocket motor fairing. Narrow-tread landing gear retracts forward, nose gear retracts aft. It has about 24 hr. testflight time, is testbed for running experiments on blown-wing principle

ual. It also accuses some companies of giving out damaging information "in their desire to build up prestige."

The committee apparently gave no consideration to the Department's administration of the Security Review Branch of the Office of Public Information. In addition, it ignored some controversial issues raised by the present Pentagon regime.

For example, an appendix to the report includes the texts of Excutive Order 10501 designed to lessen the bulk of classified material, and two directives on policy governing the use and release of information.

Not included, however—or mentioned in the report—is Secretary Wilson's directive of March 29, 1955, in which he ordered that release of material be governed by its "constructive contribution to the primary mission" of his department.

The report points out that Executive Order 10501 includes "admirable provisions relating to declassification." But, it adds, the order is not working and the backlog is virtually untouched. The reason: classification is easy; declassification is tedious.

One result of this, according to the committee, is that the "press" comes to regard secrecy stamps with feelings varying from "indifference to active contempt." These feelings are traced to such things as use of classification to protect items that are not related to security or to support a foreign policy objective. The paper work involved in declassification also is cited as a forbidding task.

Attributing most unauthorized disclosures to interservice rivalry, the committee said they are made by persons "motivated by a desire to further the interests of a particular service."

It also found that "it is understandable that different services will have different concepts and that ardent advocates of a particular concept will wish to do everything they can to weigh the balance in favor of their particular philosophy." But it finds that "excesses . . . damage the defense effort."

The remedy: Reduce the pressure by not hiding interservice rivalry and let armed forces express their opinions.

Members of the committee, in addition to Coolidge, are four retired military officers: Admiral William M. Fechteler, USN; Gen. John E. Hull, USA; Gen. Gerald C. Thomas, USMC, and Lt. Gen. Idwal H. Edwards, USAF.

Sikorsky HR2S-1 Sets Three Records

Bridgeport, Conn.—A Marine Corps Sikorsky HR2S-1 has established a world speed record of 162.7 mph., a world altitude record and a record for carrying specific payloads to altitude.

The speed record without payload, set at Bradley Field, Windsor Locks, Conn., on Nov. 11 tops the old record of 156 mph. set in 1954 by a Sikorsky XH-59.

The altitude records were set Nov. 10 at the Stratford Heliport of Sikorsky Aircraft Division of United Aircraft Corp. Maj. Roy L. Anderson was pilot and Robert S. Decker of Sikorsky was co-pilot.

The HR2S-1, powered by two Pratt & Whitney R-2800 engines, flew to 7,000 ft. carrying 13,250 lbs. The old record, set in Russia, was 6,560 ft. with a load of 8,820 lbs.

It also set a first-time record by flying to more than 12,000 ft. with a load of 11,050 lbs. This is the first specific payload-altitude record to be established. Speed and altitude trials were conducted under the auspices of the National Aeronautics Assn.

They are subject to confirmation by the Federation Aeronautique Internationale before becoming world records and will bring to six the number of records set by Sikorsky helicopters in the past six months.

The HR2S-1 is known commercially as the S-56. The Army calls it the H-37. Preliminary shipboard evaluation of the Marine version already has been conducted successfully aboard the carrier USS Tarawa, and a navy early warning radar version—the HR2S-1W—recently made its first flight (AW Nov. 12, p. 29).

Information Shroud Irks House Unit

By Katherine Johnsen

Washington—New controversy over the release of scientific and technical information erupted last week between the Defense Department's top information adviser, Assistant Secretary Robert Tripp Ross, and the House Government Information Subcommittee headed by Rep. John Moss (D.-Calif.).

Rep. Dante Fascell (D.-Fla.), acting chairman of the subcommittee, publicly accused Ross of using "a weak legal shield" to withhold recommendations of the Research and Development Policy Council on the need for an increased flow of technical information.

The group is composed of the military experts and assistant secretaries of the services responsible for research projects.

Subcommittee Charge

Observing that the release of technical information is one of the most important areas of the subcommittee's investigation, Fascell charged that Ross has "formally and officially" refused to let his group know the Policy Council's recommendations.

"The information expert of the Pentagon has decided in his wisdom to restrict information about proposals to improve the flow of information," Fascell declared.

"For 16 months, the subcommittee has been working on recommendations for legislation and for administrative improvements that will make more information available. The Defense Department recently has completed a study by experts in the field of scientific information.

"The subcommittee would like to have the benefit of the thinking of the Defense Department's scientific experts. We would like to look at the recommendations of the men who are responsible for operating the Department's research programs and for making available the scientific information which comes out of the research programs.

"It is simple for Mr. Ross to find ways to refuse information to the subcommittee; it would be just as easy for him to make the information available."

Later Rep. Moss canceled the final scheduled hearing of the week and announced that no more hearings will be held until after January because of Ross' "refusal . . . to give the subcommittee cooperation."

Moss said the subcommittee staff also needs more time to study the report of the Coolidge Committee (see page 28) and to consider proposed Defense Department changes of information policies concerning research and development.

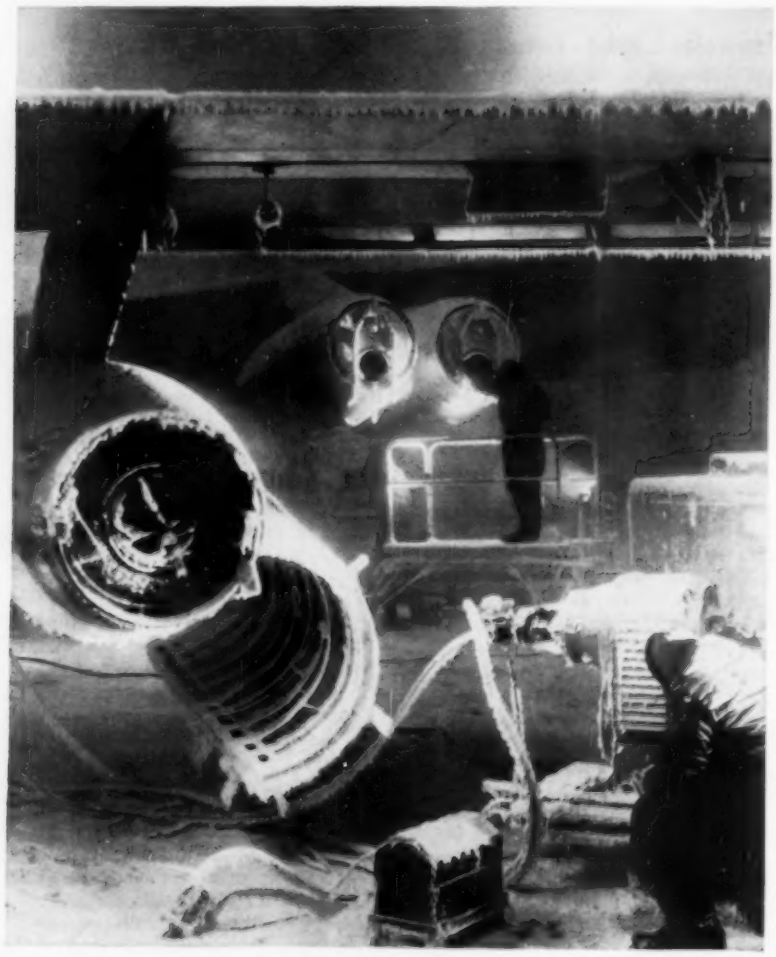
Ross had been scheduled to testify at the canceled meeting along with Army Secretary Wilber M. Brucker, Navy Secretary Charles S. Thomas and Secretary of the Air Force Donald A. Quarles.

Ross' Rebuttal

Ross also denied that he was being un-cooperative. The recommendations of the policy council, he said, are still in the form of working staff papers and can be made available to the subcommittee only after they are drafted into a formal report for submission to the Secretary of Defense.

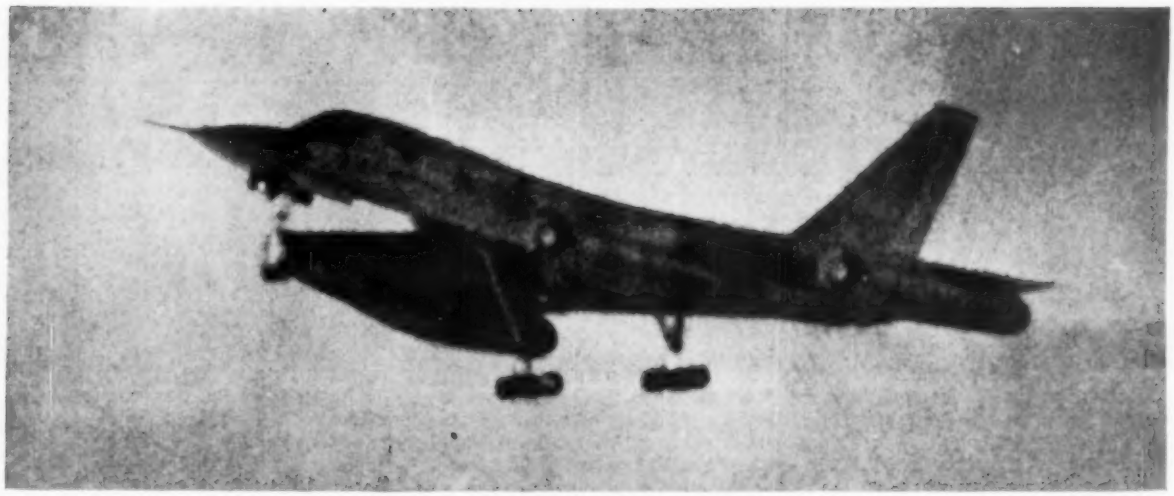
Other developments at the hearings of the subcommittee last week included:

- **Chairman Moss recommended** that a centralized office be established to handle clearance for the entire Department of Defense. Research and development officers objected to the proposal. Witnesses were Maj. Gen. John P. Daley, director of special weapons, Army; Maj. Gen. J. S. Mills, assistant deputy chief of staff for development, Air Force; Rear Adm. Rawson Bennett, chief of naval research.
- **Three witnesses insisted** that basic research information is not subject to classification until it attains military applications. Fascell commented that "any basic scientific principle can have military application."
- **Armed Services Technical Information** Agency, organized at the Defense



Climatic Ice

Boeing B-52 bomber undergoes test at —65F in climatic hangar at Eglin Air Force Base, Fla., which is used by Air Proving Ground Command to test operating capabilities of aircraft at extreme temperatures. Note heavy ice on Pratt & Whitney J57 engines. Hangar also is capable of providing temperatures as high as 165F, tropical humidity, and rain.



B-58 Makes First Flight

First flight of Convair's B-58 Hustler weapon system carrier made last week from the Ft. Worth, Tex., plant lasted 38 minutes. Photo shows plane from left front quarter. Odd shape of nacelles, angle of flight path and lack of clarity give a false impression of the Hustler's lines. Outstanding feature is the spindly landing gear, using sixteen wheels to distribute the weight more evenly on current runways. Its height is to permit the Hustler carried to straddle its weapons pods. Hustler is powered by four General Electric J79 turbojets and is expected to have Mach 2 performance over the target. Pods to be carried include an air-to-surface missile system, an electronic countermeasures system, or a bombing system, complete with auxiliary rocket motors for supersonic dash performance.

Department level to facilitate the flow of information, is not being utilized by either the services or defense contractors because of the procedural red-tape involved, subcommittee members protested.

A staff study showed that fewer than 10% of defensive contractors are making use of the agency.

• **Chairman Moss complimented** the Army and Navy for recently initating programs to prevent over-classification of information and to declassify information.

Moss observed that, "although the new Navy program is on a trial basis, it holds hope for improvement in the flow of information to the public and to scientists and technologists.

Despite the Army's aggressive declassification program, Gen. Daley reported that it would take "far more than 10 years" to bring the files up to current status. The Army's new attitude toward security classifications, Daley reported, is to emphasize the three handicaps of over-classification—it hampers current work, it discourages proper respect for security classifications and it creates a heavy administrative burden.

Moss objected to the policy under which scientists with top security clearance with one service must obtain separate clearance from another service. A centralized office for clearance would facilitate the work of the scientists, enabling them, in one step, to obtain access to information to their area from all three services, Moss maintained.

Russian Threat May Speed French Missile

Paris—French military authorities, annoyed at having to back down in the Suez operation because of Russian intervention, are expected to react by renewing their drive for some type of atomic missile program.

They feel they could have called a Soviet bluff if they had had equal weapons to back a counterthreat.

The French flew 500 missions in the first three days of the Suez operation when air activity was at its height. They caught at least a dozen twin jet Il-28 bombers on the ground, but it is believed in Paris most of Egypt's Il-28s were evacuated immediately by Russian crews who flew them to friendly airfields. Possibly this explains appearance of jet bombers at Syrian airfields.

Because opposition was virtually nonexistent, the French feel they learned no new aerial lessons. Mystere IVs apparently were held in reserve to intercept Egyptian jet bomber strikes which did not materialize. French air ministry still denies officially Republic F-84 Thunderstreaks were used, but that they were used, in fact, is an open secret.

Whether Russian threats that "rockets" might be launched against the British Isles in the event of a major war was more than psychological warfare, NATO was taking no chances Russia misunderstood the Western position—thus Gen. Alfred M. Gruenther's statement that any Russian missile attack would be met with full retaliation.

"Whether or not such rockets exist," Gen. Gruenther said, "they will not destroy the capacity of NATO to retaliate. No nation is going to press that button (to launch guided missile warfare) if it means national suicide. That is just what it would mean."

The French, who probably would have ignored Gruenther's statement a couple of months ago, hailed his departing message. "A real allied military leader," was the comment of the French Defense Ministry. Gen. Lauris Norstad, who takes over the NATO command this week, will find European interest in NATO revived.

New UAC Tunnels Range to Mach 10

East Hartford, Conn.—Three new wind tunnels covering speed ranges from Mach .5 to Mach 10 have been added to United Aircraft Corp.'s research department here.

Initially, the hypersonic tunnel (Mach .5 to 10) will be used to explore heating effects at high speeds and altitudes. The transonic (Mach .5 to 1.5) and supersonic (Mach 1.5 to 5) tunnels will be used principally to study inlet and exhaust designs of jet turbine and "other advanced type engines," United said. All three also may be used to test aircraft and missile models.

The three are blowdown type tunnels, storing air under high pressure and discharging it in short bursts for test runs. There is 75,000 hp. available for the tunnels.

Longest Solid Rocket Duration Claimed

McGregor, Texas—"Longest duration ever achieved by a large solid propellant rocket" is claimed by the Rocket Fuel Division, Phillips Petroleum Co.

The rocket incorporates a new design concept, according to Phillips, which is being investigated for the U. S. Air Force at USAF Plant 66.

Normally long duration in a solid propellant rocket means anything longer than 15 sec. One standard Jato unit now qualified has a 45 sec. duration.

Small solid propellant rockets with durations in minutes have been fired in laboratories.

Problem in long duration solid propellant rockets is keeping chamber and nozzle weights down while withstanding the temperature rise and maintaining useful thrust.

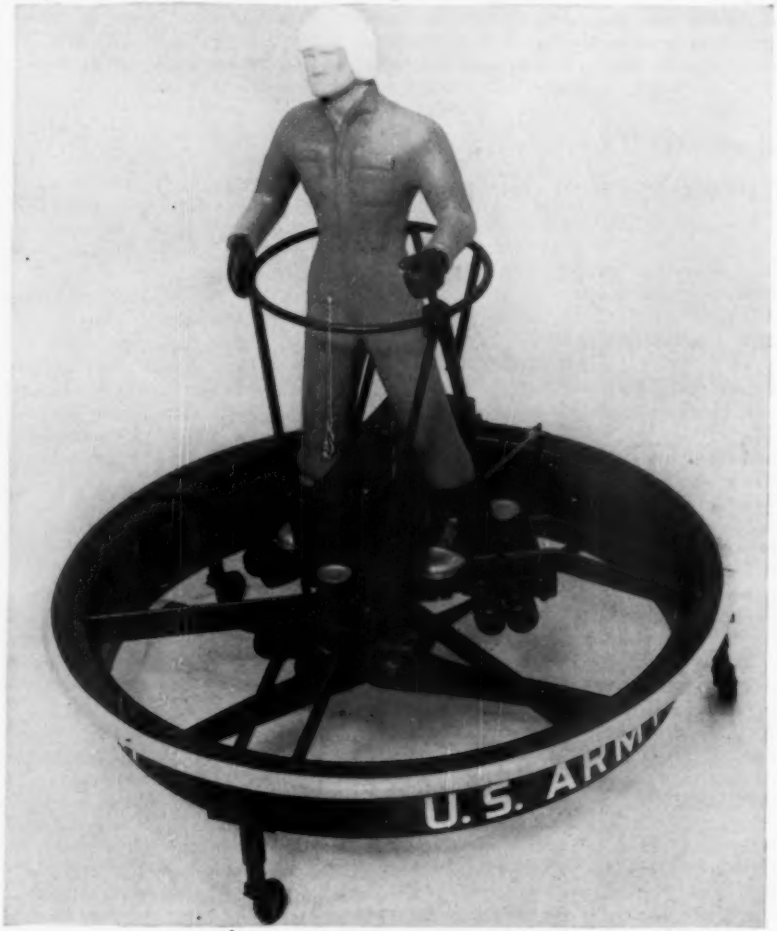
Other companies working on large long duration solid propellant rockets are Aerojet General Corp., Standard Oil Co. of New Jersey, Thiokol Chemical Corp. and Grand Central Rocket Co., according to Solid Propellant Rocket Section, Powerplant Laboratory, Wright Air Development Center.

Montreal Receives Radar Traffic Unit

The first unit in what will eventually become a nation-wide air traffic control network, was installed last week at Montreal Airport. The next city to get radar will be Toronto, then Winnipeg and Vancouver. In a year's time another half-dozen cities across Canada will also be equipped with radar to form a unbroken chain.

Canada's Department of Transport has signed a $5-million contract with Raytheon Mfg. Co. for the radar units.

The radar in air traffic control headquarters consists of a screen and scanner which registers electronic echoes from an antenna on the field, between runways. Besides showing clearly all aircraft within a 50-mile radius of the airport it will also record weather disturbances such as rain storms and cloud masses.



New Platform

Army last week announced a $500,831 order for two prototype multi-engine flying platforms (see scale model above). Manufactured by Hiller Helicopters, the platform will be powered by three 44 horse-power two-cycle reciprocating engines and includes other design refinements. The single-engine platform developed in 1955.

Scheduled Model of S-58 Includes Two New Doors

Redesign of the Sikorsky S-58 for scheduled passenger operation includes the installation of two walk-in doors. Strengthening of some skin areas and fuselage members to provide for the installation will add approximately 100 lbs. to the weight of the helicopter.

Designated the S-58C, the helicopter also will receive an additional 250 lbs. in weight from the installation of equipment necessary to meet Civil Aeronautics Administration certification requirements. AVIATION WEEK incorrectly reported on Oct. 29 (p. 23) that the total of 350 lbs. in added weight was due entirely to an increase in skin thickness.

Lockheed Receives Navy Contract for SeaStars

Lockheed has received a $70 million Navy contracts for ship-or-shore duty T2V-1 SeaStars which will extend production of the airplane through 1958. Now being flown by Navy test pilots, the 600 mph. jet trainer is scheduled to enter service in January.

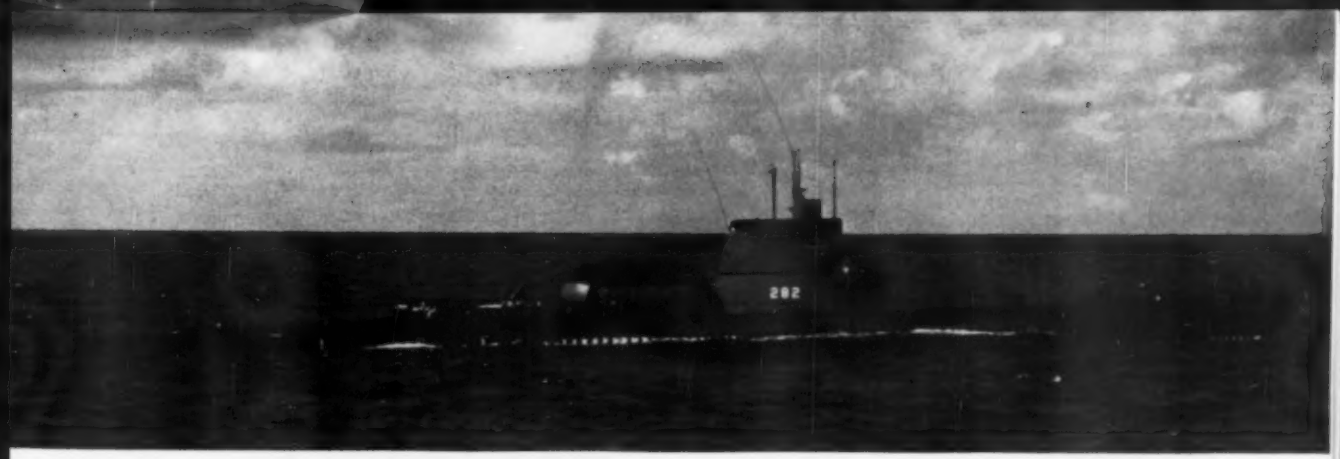
With boundary layer control as standard equipment, the T2V-1 demonstrated vertical sink rate of 20.8 fps. at a test-simulated speed of 125 mph. Company claims the two-place trainer has a carrier landing speed 97 mph. slower than any other jet.

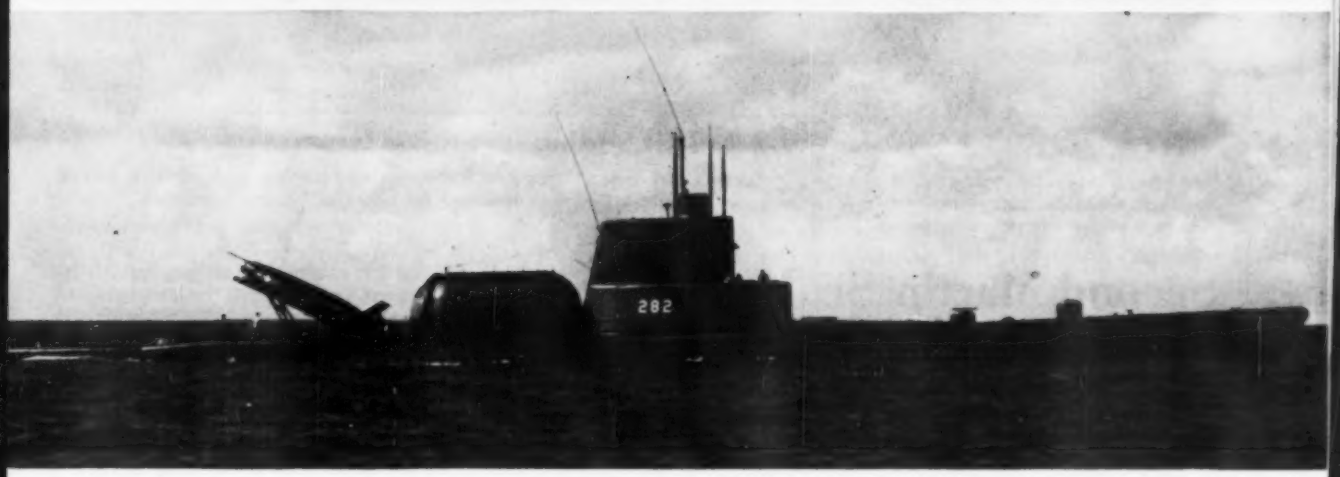
Navy Orders Tacan From Hoffman, Federal

Navy Bureau of Aeronautics has ordered $41 million worth of airborne Tacan receivers from Hoffman Laboratories, Inc., Los Angeles, and Federal Telephone & Radio Co., Clifton, N. J. Hoffman's contract for 6,001 units at $22 million indicates a per unit cost of about $3,600.

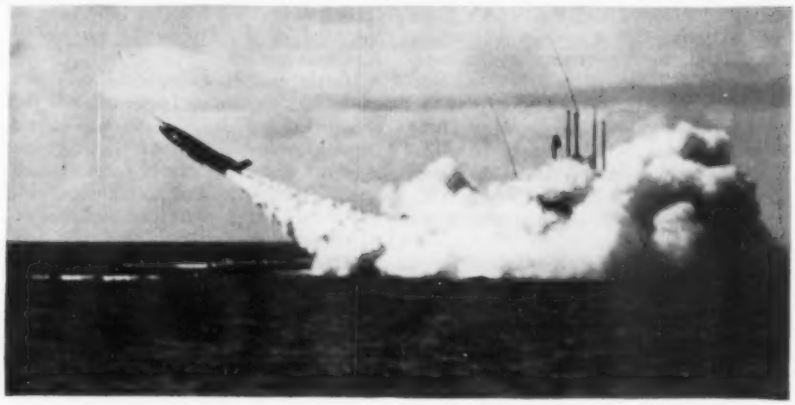
NAA Delivers First Modernized F-86D Sabre

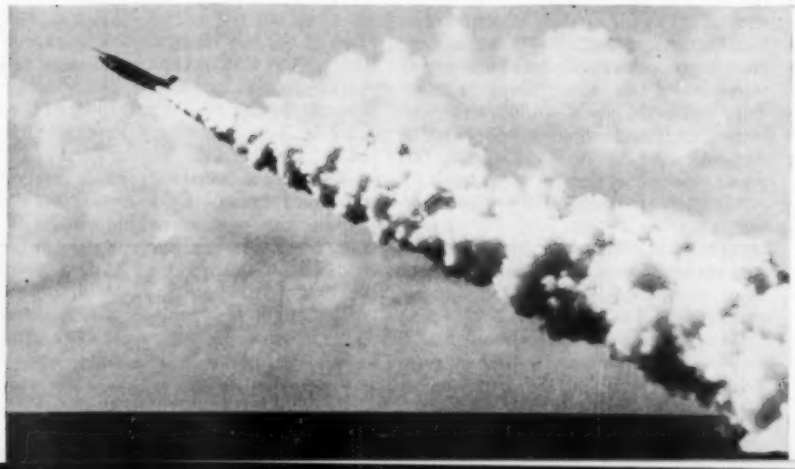
First production model F-86D to be modernized under project follow-on was delivered to USAF by North American Aviation's Fresno Division. Airplane received advanced electronic equipment, new wing leading edges and tips.





Submarine Missile System





Missile is addition to Navy's submarine armament. Here is USS Tunny which carries the Chance Vought Regulus I missile. Regulus surface-to-surface vehicle is launched from sub minutes after surfacing. Picture at top shows missile moving from hangar on deck to launcher platform during maneuvers in Central Pacific. Next lower pictures shows missile on launching platform preparatory to firing. Next Regulus leaves USS Tunny, trailing fire and smoke. Bottom, missile soars skyward.

Belly Landing

British Sea Venom, damaged by flak in operations over Suez Canal during Middle East fighting against Egyptians, lands safely on deck of aircraft carrier HMS Eagle somewhere in Mediterranean. Airplane bellied onto deck after flak made landing gear inoperative. Venoms were used for low altitude ground attack.

Second Martin SeaMaster Crash Will Not Halt Production Orders

By Evert Clark

Washington—The crash of the Glenn L. Martin Co.'s second XP6M-1 SeaMaster will not effect the Navy's plans to buy six prototype and 24 production models of the four-engine jet seaplane.

Under the present schedule, no SeaMaster will be available to continue the test-flight program until sometime next spring.

The second model took off from Martin Airport at Middle River, Md., earlier this month on a routine test flight.

Fifty-one minutes after takeoff, over the town of Odessa, Del., south of Wilmington, the plane was flying approximately level at an altitude of about 21,000 ft. and a speed of about Mach .88 having slowed from a higher speed.

Suddenly, it went into a tight inside loop against the full opposite control by the pilot. The plane was subjected to "somewhat greater than nine times the force of gravity and went out of control," the Navy said.

The pilot, co-pilot and two flight engineers—all Martin employes—ejected during the loop. The plane fell off into a downward spiral and broke up at about 8,000 ft. The pieces scattered over a farm. They have been collected in Martin's seadrome hangar at Strawberry Point, Md.

Telemetering information showed that the horizontal tail "did not follow the pilot's control but moved to a full leading-edge-down position, a position which would cause the loop," Navy said.

Determining the exact cause of the crash will be far easier this time than in the crash of the first model for several reasons:

- **Martin and Navy** have the accounts of the four crewmen. In the crash of the first model last Dec. 7, a Navy pilot and three Martin employes were killed.
- **In the first crash,** the chase plane had landed to refuel. For test flights with the second plane, two chase planes alternated so that one was near the SeaMaster at all times. A chase pilot flying a Navy jet witnessed the second crash.
- **Telemetering equipment**—far more extensive than in the first plane—gave a complete record of events immediately preceding disintegration of the plane.
- **Recovery of parts** was complete, with the obvious exception of what was destroyed. The first crash occurred over the Potomac River. In three months of salvage operations involving two salvage ships, two sonar ships, a Navy ship equipped with underwater television gear and smaller vessels using dragging rakes, some 80% of the first plane was recovered in thousands of small parts—including 193 major segments.

At least one major section of the second plane—from the aft bomb bay bulkhead to the end of the tail—was recovered intact.

Martin and the Navy concluded after the first crash that a malfunction of the control system caused the horizontal tail to turn upward suddenly, throwing the plane into the beginning of an outside loop (AW Nov. 5, p. 31).

Exact reason for the malfunction never was determined, although the investigation narrowed it to six possible causes. Precautions taken with the second model were to eliminate all six.

The same Martin team which investigated the first crash is handling the second one. This investigation, like the first, probably will include Air Force, National Advisory Committee for Aeronautics and Civil Aeronautics Board.

The first SeaMaster had completed 79 hours of taxi and flight tests. The second plane had been flying since last May. Navy has ordered six YP6M prototypes. Last August it placed a $102,163,427 order for 24 production models.

Convair Will Use Four Atlas Bases

San Diego—Four bases will be used by Convair Division of General Dynamics Corp. to test USAF's Atlas ICBM. Two of the test bases are Convair facilities in San Diego. The third is at Edwards Rocket Base on the Mojave Desert; the fourth is a part of Air Force Missile Test Center at Patrick AFB, Fla.

One of the San Diego bases, located on Point Loma, is for testing missile components without engine runs or firing. The other San Diego base, nearing completion in Sycamore Canyon, will check out Atlas systems by running the rocket engines. No missiles will be fired.

Test launching will take place at Pat-

rick over the missile range that extends into the South Atlantic.

A $40-million Convair-Astronautics plant now under construction in San Diego will produce the Atlas. Research and development leading toward space travel also will be based at new plant.

New Warning Device Revealed by Hughes

Hughes Aircraft Co. has revealed that it is developing an aircraft proximity warning indicator (PWI) and automatic collision avoidance system in competition to the one under development by Collins Radio Co. (AW Sept. 24, p. 37).

First details on the Hughes system were reported during a recent industry meeting with the Federal Communications Commission, held to discuss frequency allocations for the new PWI systems. Hughes plans to use a pulse-type radar, possibly adding a doppler technique for the automatic collision avoidance portion of the system (Phase II). The radar will have a peak power of 100 kw and pulse width of 0.5 microsecond.

A Collins representative indicated that a pulse-type system with high peak powers operating at the same frequency as their continuous-wave frequency-modulation PWI could cause crystal burn-out, incapacitating their system. This raises the prospect of requiring separate frequency bands for the two different types of systems.

New 375C Diodes

Maximum operating temperature of silicon diodes has been increased to 375C, near double the previous limit, using new technique for treating semiconductor junction surface. Technique was developed by U. S. Dynamics Corp., a year-old Boston company formed by scientists previously employed by several major semiconductor manufacturers. New technique, or similar one, may be applicable to transistors although company has not yet explored this possibility, according to Dr. Walter Strimling, president. Sample quantities of the new 375C diodes should be available in several months. Company's address: 1250 Columbus Ave., Boston 20, Mass.

A subsequent industry meeting held by Aeronautical Radio, Inc., tentatively agreed to a requirement for a 100 mc. band in the frequency range of 2,900 to 3,500 mc., centered as nearly as possible on 3,200 mc. to provide protection from unwanted signals from military radars and other equipments. Additional study of manufacturers' requirements and classified military equipment frequencies will be required before the situation can be resolved.

Navy representatives at the FCC meeting revealed that the Navy is interested in installing PWI equipment aboard carrier aircraft in the near future.

Correction

Washington—Air Force business with small firms dropped from 9.3% of the total dollar volume in Fiscal 1955 to 8.3% in Fiscal 1956. The decline was incorrectly reported as from 9% to 5% on page 31 in the Oct. 29 issue of AVIATION WEEK. The total of USAF prime contracts increased from $6.5 billion in Fiscal 1955 to $8.6 billion in Fiscal 1956. The small business volume increased from $576 million to $686 million.

Military Aviation Funds

Defense Department's net obligations—new contracts less cancellations—for aircraft, engines, and parts in Fiscal 1956 totaled almost $8 billion, nearly twice the $4.1 billion for Fiscal 1955. Expenditures declined slightly, from $7.9 billion in Fiscal 1955 to $7.8 billion. Here are details for Fiscal 1956, which ended June 30, and the previous fiscal year as released by the Department of Defense.

	OBLIGATIONS (000 Omitted)			EXPENDITURES (000 Omitted)		
	Fiscal 1955	Fiscal 1956	Unobligated Balance, July 1, 1956	Fiscal 1955	Fiscal 1956	Unexpended Balance, July 1, 1956
Aircraft, Engines, Parts:						
Air Force	$4,345,304	$5,138,926	$3,290,736	$6,294,840	$5,181,191	$9,631,939
Navy Minus	199,045	2,059,935	1,340,679	1,675,765	1,840,578	4,272,460
Army	134,295	129,222	44,169	66,528	133,891	277,505
MDAP Minus	98,268	665,650	1,352,525	68,338	654,172	1,702,363
TOTAL	$4,182,286	$7,993,733	$6,029,109	$7,968,795	$7,799,832	$15,884,267
Guided Missiles:						
Air Force	$547,934	$859,719	$326,379	$305,077	$640,930	$1,066,061
Navy	116,589	232,576	136,321	175,572	194,556	404,516
Army	349,554	354,034	49,340	87,768	332,900	735,730
MDAP	.....	.....	.....	.....	.....	.....
TOTAL	$1,014,077	$1,446,329	$512,040	$568,417	$1,168,386	$2,206,307
Electronics & Communication Equipment:						
Air Force	$730,664	$582,504	$420,407	$449,915	$513,570	$1,139,947
Navy	107,973	137,978	73,049	158,725	103,264	263,985
Army	198,568	239,811	26,548	27,778	153,326	460,633
MDAP	153,961	149,503	264,198	259,542	126,801	341,818
TOTAL	$1,191,166	$1,109,796	$784,202	$895,960	$896,961	$2,206,383

B-52 Bomb Station

B-52 bombardier-navigator station, in this first released view, shows controls for Sperry K-system, including radar scope (1) for high altitude overcast bombing, alternate optical bombsight (2), and maneuvering control (3) which enables bombardier to take over and fly airplane to the target. Navigator sits on bombardier's right. K-system costs about $200,000 and is produced by nearly a dozen prime and major sub-system contractors. K-system is designed to permit B-52 to navigate through the polar regions. Later model B-52s will use more recent bombing-navigation system developed by International Business Machines Corp.

News Digest

Douglas Aircraft Co. made first factory-to-fleet delivery of A4D Skyhawk just four years to the month after mock up inspection. A4D was assigned to Attack Squadron 72 at Quonset Point, R. I.

De Havilland Holdings Ltd. has acquired an interest in Saunders-Roe Ltd. with eye to integrating overseas marketing activities.

Finland purchased Orpheus-powered Folland Gnat fighters, the seventh country to adopt the Bristol Orpheus engine. Delivery will begin next year.

Air France received a Super Constellation 1049G simulator from the Electronics Division of Curtiss-Wright Corp. last month. A Super Constellation 1649A simulator will be delivered in 1957.

First C-130 Hercules to be used for Arctic testing was flown from Lockheed's Marietta, Georgia, plant to Wright-Patterson Field for cold-weather instrumentation and outfitting.

Folland Aircraft Ltd. will offer additional shares to stockholders to finance new Gnat contracts.

Third prototype of Bristol 173 helicopter completed its first flight powered by 850 hp. Alvis Leonides Major engines. Two previous prototypes were equipped with 520 hp. Alvis Leonides engines.

Cal-Tronics Corp. will be represented in the sale of electronic testing equipment for radar, guided missiles, and fire control by B. B. Taylor Co. at Rockville Centre, N. Y., and American Engineering Sales Corp. at Miami, Fla.

Lockheed Aircraft Service Inc. will open new base at Honolulu International Airport about Jan. 1, 1957, under terms of a Navy contract. New facility will provide maintenance for Super Constellations of Airborne Early Warning Wing.

Atlantic Research Corp. will start construction early in 1957 on million-dollar offices and research laboratories in Fairfax County, Virginia, eight miles from Washington. The company has been active in the development of solid propellants for various rockets and missiles.

New York University will try to answer the problem of smogged-in airports by a systematic study of the relationship of air pollution and fog at New York City area airports.

Navy contract for development and manufacture of aerial refueling equipment for Marine Corps helicopters was awarded to Flight Refueling Inc.

Temco Aircraft Corp. sales were $61,196,203 for the first nine months of this year, a 6.6% gain over the same period of 1955. Net earnings were 12.4% lower—$2,059,189 compared with $2,350,708 in 1955.

Subcontract of $10 million from Chance Vought Aircraft went to Evansville Division of Whirlpool-Segar Corp. for manufacture of control surfaces for the F8U-1 Crusader.

Joint field liaison offices were established by Reaction Motors and Olin Mathieson's Aircraft Division in Dayton, Ohio, and Los Angeles, Calif.

Nine months record was set by Servomechanisms, Inc. with 1956 net profits of $482,114 on sales of $12,297,937. Comparable figures at the three-quarters mark last year were $334,671 and $9,268,945.

Aerojet-General Corp. of Azusa, Calif., purchased Ordnance Engineering Corp. of Frederick, Md. Aerojet plans operation of company in field of special range instrumentation, fuse work and in the area of airborne electronic devices.

NEW from EEMCO

A 400 Cycle AC Linear Actuator

with an operating range of

320 to 480 cycles

SPECIFICATIONS FOR TYPE D-818

Normal operating load: 6000 pounds
Maximum operating load: 12,000 pounds
Ultimate static load: 24,000 pounds
Stroke: 3.15 inches
Rate of travel: .33 inches per second
Amperes: 3 amps. at 480 cycles on 200 volts at the 6000 lb. load
Weight: 20.5 pounds
Qualification: Type D-818 has been designed and qualified to meet applicable military and aircraft manufacturers' specifications.

EEMCO 400 cycle linear actuator **Type D-818** is being installed as a leading edge flap actuator in the latest and fastest supersonic fighter aircraft now being produced for the U. S. Air Force.

Incorporated in the **EEMCO** motor in **Type D-818** is a torque-limiting AC clutch which disconnects the high inertial load imposed by the motor's armature. A brake can be built into this mechanism if **Type D-818** is altered for use in another capacity. Adjustable non-jamming stops are included which are especially convenient when the airplane is being rigged.

One of its outstanding features is that it operates on a frequency range of 320 to 480 cycles, versus a normal range of 380 to 420 cycles. This eliminates need for a constant speed drive for the airplane's generator system, thereby saving maintenance of same as well as considerable cost and weight.

EEMCO is a specialist in the design and production of precision-built actuators and motors. The majority of the latest and fastest aircraft and missiles being produced for the U. S. Department of Defense carry one or more **EEMCO** systems. Industry, too, is using **EEMCO** linear and rotary actuators where precise control of mechanical actuating systems is imperative.

Electrical Engineering and Manufacturing Corp.

4612 West Jefferson Boulevard
Los Angeles 16, California
Telephone REpublic 3-0151

Designers and producers of motors, linear and rotary actuators . . . exclusively!

3-544

FORESIGHT— Northrop Aircraft's long-range vision is continuously focused on new horizons. Advanced planning by Northrop scientists, engineers and administrators has resulted in the development of formidable aerial weapons for our national safety. Among them are the atom-armed Northrop Snark SM-62s, first intercontinental missiles to be disclosed by the U.S. Air Force, and the Northrop Scorpion F-89 interceptors, lethal guardians of our defense perimeter. In addition, Radioplane Company, a Northrop subsidiary, has delivered over 40,000 pilotless aircraft for use by all branches of the military. At Northrop, today's goal is tomorrow's starting point. In this forward-looking spirit, Northrop is continually achieving scientific breakthroughs which contribute to our national progress and welfare.

NORTHROP

NORTHROP AIRCRAFT, INC. • HAWTHORNE, CALIFORNIA

Pioneers in All Weather and Pilotless Flight

ALPA Outlines Jet-Age Bargaining Plan

Basic wage and rules program drafted by pilots' union at biennial convention in Chicago.

By L. L. Doty

Chicago—The pattern of collective bargaining airlines can expect with the coming of jet transports has been brought into sharper focus.

In its first comprehensive study of jet operations, the Air Line Pilots Assn. drafted a basic wage and rules program for the jet age during a series of controversial sessions at its 14th Biennial Convention which came to a close here last week. The jet problem proved to be a pivotal issue effecting other agenda items during the eight-day convention during which Clarence Sayen was unanimously re-elected to a four year term as ALPA president.

The jet transport sessions were begun with a number of resolutions proposed in a detailed report prepared by the union's Turboprop and Jet Study Committee. While many of the resolutions drew fire from the some 400 delegates and were turned back for further committee revisions, an insight to ALPA's future philosophy on jet operations did emerge.

Jet Study Report

From a study of the report, this much is clear:

• **ALPA may demand** a third pilot crew member on turboprop and turbojet transports and may require all members of operating crews to be qualified as pilots. Most delegates seemed to feel that, if such a program were adopted, no objection would be raised to training currently employed flight engineers as pilots to enable them to qualify as crew members. The committee also suggested that steps should be taken to insure job protection for non-pilot crew members.

• **Demands for reductions** of monthly flight time may not be made during initial stages of jet operations. The committee recommended that pilots withhold efforts to cut flying hours until the proper pay for operating jet equipment is established.

• **Problems of pilots operating** turbine aircraft will not be processed to the exclusion of pilots assigned to existing aircraft.

• **Pilots will retain present wage** structure or increment method of pay in negotiations on jet transport operations.

• **Emphasis will be placed** upon training in making transition to jet transports to insure continued safety and cockpit efficiency.

• **Negotiations will be conducted** on an individual basis with each airline rather than on an industry-wide scale.

Third Crew Member

On the question of the third crew member, the committee urged against any attempts to replace present flight mechanics on reciprocating-engine aircraft. However, it said it doubted the value of a mechanic crew member on turbine aircraft.

It noted the absence on jet and turboprop aircraft of such piston engine cruise control characteristics as manifold pressure, propeller rpm, mixture settings for percentage leaning or engine analyzer monitoring. In contrast, it pointed to the limited number of instruments and switches on the third crew member panels of the Douglas DC-8 and Boeing 707 jet transports. Most vital instruments requiring cruise monitoring, it added, are located on the pilot's instrument panel.

The report concluded that a pilot would be as qualified as a mechanic in the third crew member position and have the added advantage of providing a "fail safe" protection in the event of an emergency. The committee also recommended the use of Captain, First Officer, Second Officer, etc., to replace crew titles of flight engineer, navigator and radio operator.

A progressive approach toward the reduction of flying hours was advocated in the report.

It termed adequate minimum working conditions for pilots on all equipment the first important point in the progressive approach. Desirable working conditions are described in the report as those that result in maximum flight time with minimum time spent away from home.

The second aim in the overall program is to peg speeds of turboprops and jet transports to an area that will produce wages commensurate with the productivity of the equipment. The report warned that these two items will meet with the concerted resistance of the airlines. It concluded that the addition of demands for reduced flying time to proposals for better working conditions and pay contingent upon the speed of the aircraft creates a complex package that would further stiffen this resistance.

The committee also expressed a fear that inequities for the entire pilot group would result if a program for jets were to be developed without consideration for piston engine pilots. It said the sum total of working conditions and wage problems on any given airline involves the integration of the entire fleet of aircraft.

The committee said the increment pay system was more adaptable to collective bargaining processes than a flat pay system and best suited to ALPA's bidding and assignment procedures. While delegates were in accord with the committee's findings, the delegates voted to seek methods of improving the system without drastically revising its basic structure.

Pilots are expected to adopt comprehensive training programs that will include detailed ground and air training curriculum in jet transport operations.

Jet Physical Demands

The committee recommended rapid decompression training for jet pilots and pointed out that at least one manufacturer requires its test pilots to undergo controlled rapid decompression in a pressure chamber. It reported that explosive decompression has a confusing and disorganizing effect that slows down reaction.

Physical demands for jet and turboprop operations are not expected to exceed the physical standards required of present day airline pilots, the committee reported. It added that active test pilots on jet transport programs are of approximately the same age as active airline pilots.

It did suggest, however, that new problems of a physical nature may be posed by high altitude jet operations with rapid decompression and the accompanying lack of oxygen appearing to be the most serious.

As a consequence, the committee report asked for the formation of a Physical Standards Subcommittee to monitor research and development in aero-medicine. It pointed out that continuous operation of jet and turboprop equipment may have a long-range effect upon the health of flight crews. Areas most suspected by the committee are oxygen poisoning, cosmic ray exposure, microwave radiation exposure, lack of humidification, visual glare on

eyesight, cumulative fatigue and cockpit noise.

Traffic Control Demands

In the field of air traffic control, ALPA asked for these essential requirements:

- **Air traffic system** must provide 60 landings and 60 take-offs per hour on dual runways.
- **System must provide for** the use of airports as close together as those in the New York area without traffic interference, and it must allow flights to climb, cruise and descend within the normal best performance ranges of the various types of aircraft.
- **Must be capable of holding** flights in a safe position when flow of runway traffic has been interrupted by weather or other causes.
- **Jets and piston engine aircraft** must be spaced together in landing sequence with no reductions in landing rate, and jets must be fed into final landing from at least 20,000 feet.
- **Precise intervals in landing streams** must be opened to allow for takeoff flights. It should not require more than four minutes advance notice to open an exact interval in the flow of landing flights to permit takeoffs.

Officers elected to head ALPA, in addition to Sayen, were Grant LeRoux, Pan American World Airways captain, first vice president; J. D. Smith, Trans World Airlines, treasurer; and Robert Tuxbury, United Air Lines secretary.

British DH 118 Plans Challenged

London—Plans to develop the new de Havilland DH 118 jet transport for use by BOAC in the 1960s were challenged in the recent civil aviation debate in Parliament.

Labor Member Frank Beswick charged that the new de Havilland airplane will be similar to the Vickers V.1000 which was canceled last year.

"Whatever variation or changes in takeoff performance and so on there may be in this new aircraft, such changes could have been forthcoming in the V.-1000," Beswick said. "The net result of all this is that we are now starting on this British machine with British Conway engines 18 months after work was stopped on the other."

The decision by the Ministry of Supply to cancel the Vickers jet transport when the prototype was nearing completion set back work in Britain on this type aircraft by 18 months, Beswick said.

"Within those 18 months almost every major operator in the world has committed himself to the DC-8 or the Boeing 707," he said. Minister of Civil Aviation Harold Watkinson replied that the DH 118 will be nothing like the V.-1000 and that it is being designed to perform quite a different function.

"That is why I think it will sell," Watkinson said.

Beswick noted that the DH 118 is to have Conway engines, the same engine which was slated for the V.1000. He said that its performance therefore cannot be greatly different.

Beswick charged that the Ministry of Supply had in effect taken the contract away from Vickers which was doing well with Viscount sales and had given it to de Havilland in order to support the less successful Comet builders. "That is not planning," Beswick said. "It is merely propping up. I think that we should do better to build on success rather than to buy some new aircraft out of a less successful company."

Minister of Supply Reginald Maulding replied that BOAC did not want the Vickers jet and the government was not prepared to support development of an aircraft for which BOAC had no requirement. It was pointed out that BOAC now has a requirement for an aircraft such as the new de Havilland.

Beswick asserted that the government was forcing BOAC to buy an airplane it does not want.

I do not believe that BOAC voluntarily wishes to buy this particular machine," he said.

Minister of Supply Maulding pointed out that BOAC for many months has been interested in an aircraft with transatlantic performance plus more flexible performance than that of the large American jets. "I cannot quite understand why the honorable gentleman is making so much of a mystery of this," Maulding said.

Beswick suggested that the Minister of Supply was responsible for canceling the contract for the V.1000 on one hand and on the other was "giving another contract to another company for a similar sort of aircraft operating roughly at the same kind of range and weight and using the same engines."

Electra Production Details Underway

Burbank, Calif.—Production detail work is well under way on Lockheed Aircraft Corp.'s Electra turboprop transport, scheduled for first flight in January 1958. Sales of the plane to date total 128.

More than 2,000 different parts needed early in the Electra production cycle are already in work. Sub-assembly operations are set to start in January; final assembly is scheduled for July.

Orders for manufactured parts are now being released for production at the rate of 700 per week, while in mid-December 2,500 new shop orders are scheduled to be released in one week.

Lockheed is now constructing a 68,000-sq. ft. building at its Bakersfield, Calif., facility to house production of the Electra empennage. Engineering and tooling is nearly complete for manufacture of wingtips and wing trailing and leading edges at Temco's Dallas plant.

A new engine starting system for the Electra is in production at AiResearch Mfg. Co., Phoenix.

Powerplant assemblies and nacelles are being developed by Rohr Aircraft, San Diego. Engineering and master tooling for the nacelles is practically completed and actual fabrication has begun. Menasco Mfg. Co., Burbank, which is engineering the main landing gear, will start fabrication of these assemblies in January.

Production of the turboprop engines, model 501 D-13, is on schedule at the Indianapolis plant of General Motors' Allison Division. It is expected that the combined total time of the T56 military version in Lockheed's C-130 Hercules and the commercial D-13 version will be approximately 800,000 hr. before the Electra carries any passengers.

General Motors' Aeroproducts Division, Dayton, is also on schedule in the manufacture of the four-bladed hollow steel props ordered by five airlines—American, Eastern, National, Braniff and Western. KLM Royal Dutch Airlines will use Hamilton Standard four-blade props.

South Atlantic Fare Of $470 Is Sought

Buenos Aires—New tourist fare between Rio de Janeiro and Lisbon has been recommended by vice presidents of airlines serving the South Atlantic routes who met here this month under the auspices of International Air Transport Assn. The recommendations, which also call for a slight increase in the first-class fare between the two points, must be approved by IATA mail vote and by the governments of the member airlines.

A one-way tourist fare of $470 is proposed, marking the introduction of tourist service over the South Atlantic. An IATA enabling resolution previously had authorized a fare of $100 less than the $628 first-class price, but the fare was never instituted.

The new recommendations set the first-class fare between Rio and Lisbon at $665. Effective date of the new fares would be Mar. 1.

American Asks CAA to Dismiss Flying Tiger's Freight-Rate Bid

By Craig Lewis

Washington—American Airlines asked the Civil Aeronautics Board last week to dismiss Flying Tiger Line's petition for an increase in minimum freight rates.

Flying Tiger asked the Board to raise present freight rate minimums by 3%. The request was based upon increased costs, and, the cargo carrier said, the increase should come in time to affect income during the Christmas rush.

American called the Flying Tiger proposal an invitation to the CAB to fix actual rates, rather than minimums, and contended that a rate increase would not help Flying Tiger out of its financial difficulties.

Although the CAB historically has set minimum rate levels rather than actual rates, the airlines' rates generally are the same as the minimums. Thus, when the Board changes rate minimums, it also changes the actual rate level.

Costs Declining?

American said Flying Tiger is asking the Board to take over the basic rate-setting function of management. CAB usurpation of this function, it said, is contrary to the intent of Congress and the basic purpose of the Minimum Rate Order.

Such action would damage the development of air freight, American argues, because this segment of the airline business is still relatively new and in its early developmental stages. "Management," it added, "needs and should be given maximum flexibility for decision in order to hasten the full development of air freight."

American said the petition "graphically demonstrates that the Board is now in fact being asked to substitute rate-making by government sanction for the traditional goal of rate-making by private management, sensitive to the regulatory forces of competition."

Flying Tiger Petition

The trunk carrier disputed Flying Tiger's claim that costs are up, and maintained that the cost trend is actually declining. At any rate, American claims, an increase in rates would not benefit Flying Tiger but would hurt the cargo line's profit position, as well as the profits of other carriers. It adds:

"If Flying Tiger has need for improving its profit position, it can take unilateral action apart from the minimum rate order to remedy this situation.

Flying Tiger Line filed its petition for increased minimums after efforts to increase tariffs were stymied by American. The carrier pointed out that last August it filed a 3% general rate increase. This was followed by similar action by United Air Lines, Trans World Airlines and Slick Airways.

American Refusal

The carriers were forced to withdraw the increase for competitive reasons when American refused to raise its rates. Flying Tiger said the effect of American's action was to block a badly needed freight rate increase and to prevent Flying Tiger and the other carriers from raising freight rates to a level required by current costs.

Flying Tiger told the Board American should not be permitted to control the air freight rate structure and "thereby nullify freedom and responsibility" which the Board gave all freight carriers. The carriers also said that American uses a two rate system, charging higher rates where it has no competition.

In support of its plea for higher rate minimums, Flying Tiger told the CAB that costs have increased about 8% since the last minimums were set in 1953, and that its freight operations lost money in 1953, 1954, 1955 and during the first half of 1956. Flying Tiger said that examination of the records of other carriers will show the same picture.

The cargo carrier told the Board that Slick, United, TWA and Flying Tiger have ordered increases effective Nov. 30 and that, if American fails to go along, the four carriers will be at a serious competitive disadvantage.

Arguing that cost records are now on file and that no hearing is necessary, Flying Tiger urged the Board to take immediate action and support a 3% rate increase by raising present minimums.

Aviation Labor Representatives Organize Legislative Committee

Washington—Aviation labor unions have banded together to form an AFL-CIO Aviation Legislative Committee designed to promote legislation concerning air transport problems.

After its formation, the new committee called for establishment of an independent Civil Aeronautics Administration and urged a "dynamic program of airport and air facility construction to meet the needs of today's age of flight."

The AFL-CIO group said there is a need for a fully independent CAA with full responsibility for movement of civil aircraft and with the power "to assure air safety and the construction of adequate terminal and intermediate facilities."

The CAA, it said, should be freed of "domination of the business interests of the Department of Commerce as an imperative first step toward a disaster-free air transport system."

ALC's Statement

ALC's initial policy statement points out that William Barclay Harding, who recently headed the Aviation Facilities Study Group, found that the development of airports, communications, navigation aids and air traffic control systems has lagged behind current needs of the industry.

Endorsing this conclusion, the committee said union members are required "in far too many instances to handle air traffic in airports and with facilities designed for 10, 15 or even 20 years ago." It added:

"Aviation industry workers, no matter how alert and well trained, cannot be expected to cope with today's problems equipped only with yesterday's tools.

"The vigilance of the airline pilot must be reinforced with automatic equipment which will warn of danger in sufficient time to avert tragedy."

In its policy statement, the AFL-CIO committee blamed the inadequacy of the present traffic control system upon the failure to fix responsibility for the development and installation of automatic and semi-automatic safety devices and for the construction of proper port facilities.

New Committee

The new committee will be headed by Larry Cates, Washington representative of the Air Line Pilots Assn. Vice chairman is Frank Heisler, International Assn. of Machinists. Secretary is Frank A. O'Connell, Transport Workers Union.

Organizations included in the Aviation Legislative Committee are: Air Line Pilots Assn.; Air Line Dispatchers Assn.; Automobile, Aircraft and Agricultural Workers; Brotherhood of Railway Clerks; Flight Engineers Intl. Assn.; International Assn. of Machinists; Transport Workers Union (Air Transport Division); Industrial Union Dept. (AFL-CIO), and the Department of Legislation (AFL-CIO).

ATC Votes to Liberalize Rules Governing Tourist-Agent Relations

Washington—Air Traffic Conference has liberalized the rules governing relations with travel agents that caused a congessional controversy last spring and inspired a Civil Aeronautics Board investigation.

In its fall meeting, the ATC voted to change procedures for selection and retention of travel agents and proposed a new standard ticket for travel agent use.

The new rules, which still need CAB approval, make it easier for an agent to establish himself as an airline representative. They also make it harder for the airlines to disqualify an agent as their representative, and they set up a system of appeals and arbitration.

As a result of the change in regulations, a travel agent will be able to apply directly to the ATC for authorization if he cannot get an airline to sponsor him. ATC will act on the application if an airline says it intends to employ the applying agent.

ATC also decided to hold quarterly meetings of its Agency Committee to speed consideration of applications. The committee meets only once a year.

The conference also changed removal methods. Under present rules, the travel agent has to receive a ¾ vote in his favor to be retained. The new rules require a ¾ vote to remove a travel agent.

If the Agency Committee rejects or removes an agent, he will now have an opportunity to appeal the decision to a board of arbitrators. The board will be composed of an arbitrator selected by the agent, one selected at ATC and a third chosen by the first two arbitrators.

In another move, the ATC approved "in principle" a standard ticket for travel agent use. If the plan is fully endorsed by the airlines, it will allow agents to use a single ticket for all carriers in place of the present practice of using different tickets for each airline.

Along with this universal ticket plan, a central banking plan has been proposed. Instead of reporting to individual airlines to settle accounts, the agents would report to designated area banks. The banks probably would be in New York, Chicago, Los Angeles, Seattle, Jacksonville and Dallas.

The standard ticket and central bank plans have only tentative endorsement thus far. ATC will meet with the Airline Finance and Accounting Conference to develop a final plan.

ATC reorganized its committee structure at the fall meeting in an effort to give better representation to all-cargo carriers which recently joined ATC.

The conference elected Rex Brack, Braniff Airways' vice president of traffic and sales, as ATC president for 1957. He replaces Arthur F. Kelly, vice president-sales, Western Air Lines.

The travel agent situation was commented upon earlier this month by Capital Airlines President J. H. Carmichael at the Chicago meeting of the American Society of Travel Agents.

Carmichael said the airlines must recognize the merchandising value of travel agents and see that they have the economic incentive to sell and promote the carriers' product. He added:

"In addition to a revision and rework of the basic commission structure, ways must be found for our industry, as the manufacturer or producer, to assist financially in the promotional or advertising efforts of the travel agents to develop mass or group movements of travel."

Carmichael said his company favors the adoption of a program for no-show penalties "which will provide for indemnification of the travel agent from the proceeds of any penalty assessment applied against business the travel agent may have originated."

Carmichael also proposed study of Air Travel Plan rules under which travel agents get no compensation for handling business sold through travel cards. "Let's study the problem," he said, "and if the rule is wrong, the rule should be changed."

Lufthansa Super G in Beirut

Lockheed Super G Constellation sits before modern terminal at Beirut Airport, Lebanon, after Lufthansa flight from Hamburg. Flight also serves Bagdad and Teheran. Lufthansa plans expansion for coming year, recently announced it flew 50,400 passenegrs across the Atlantic in first year and a half of operation.

Brazilian Mergers Spur Equipment Race

By Peter Weaver

Rio de Janeiro—Brazilian airlines are following a pattern of consolidations and mergers that is intensifying competition and promoting orders for new equipment.

The nation's carriers are growing smaller in number and larger in size, and they are turning to new equipment to help them in the stiff competitive battles for traffic.

Brazil's great size and population, plus the lack of good surface transportation, have supported the growth of a large system of carriers based, for the most part, upon DC-3 operations. Now the pattern is changing.

The Brazilian airline system is consolidating into fewer, larger carriers. Where there were 18 airlines five years ago, there are now six, and the prospects of further mergers are bright.

These mergers, plus heavier competition at home and new competition from abroad, are pushing Brazilian airline executives into decisions on new equipment that they would like to postpone —much like their American counterparts.

But favorable financing for piston transports through the Export-Import Bank and easy financing offered by British and French firms selling turboprops and turbojets are easing the Brazilians' problems somewhat.

New Orders Pending

The airlines have already ordered various types of piston transports from U. S. manufacturers in an effort to modernize their fleets, and decisions are now being made on turbine transports for future operations.

Varig Airlines, having just completed its first year of service to New York, is working on a merger and trying to plan an equipment program that eventually will lead to a nearly all-turbine operation.

The carrier is effecting an operating merger with VASP, an airline owned by the state of Sao Paulo. The merger will give Varig the benefit of the smaller carrier's routes in southern Brazil.

To meet intensive competition on lucrative coastal routes, Varig is highly interested in the Vickers Viscount. The airline favors the Viscount because it wants a turboprop transport for its coastal routes, and the British airplane will be able to operate in major coastal airports.

Delivery dates are important, too. Varig President Ruben Berta told AVIATION WEEK his company looked at the Lockheed Electra because of its past experience with Constellation equipment but pointed out that Lockheed could not deliver before 1959 or 1960. "By that time," he added, "we would be dead ducks."

Buying Viscounts will help Varig toward its goal of all-turbine operations on coastal and overseas routes and also will blend with VASP's plans to buy five Viscounts. Varig will probably add 10 or 11 Viscounts later.

707 for Varig?

For overseas routes, Berta said his airline favors the Boeing 707-120, and chances are Varig will buy three of them. The Boeing is favored because its range is good enough to handle the Porto Alegre-Sao Paulo-Rio-Belem-Trujillo-New York route, yet it is not too heavy for Brazilian landing strips.

Explaining the theory behind his buying moves, Berta said:

"We feel we have to get a turboprop short-to-medium-range plane on Brazil's highly competitive coastal route as soon as possible." Pointing up this need for modern aircraft, Berta explained that, when such novelties as air conditioning and Cinemascope movies came to Brazilian theaters, gadget-loving Brazilians "flocked to the modernized theaters, leaving the others flat."

Other airline officials back up Berta's sales theory, saying: "Nobody goes on a DC-3 out of Santos Dumont Airport in Rio to Sao Paulo or Belo Horizonte any more, unless they can't get one of REAL's Convairs or VASP's Scandias."

Varig already has two Lockheed 1649A Super Star Constellations on order to complement its fleet of three Super-G Constellations and probably will order two more 1649s. The Export-Import Bank has financed nearly $7 million of the Constellation purchases thus far, and Berta hopes for more help on his purchases of U.S. equipment. He says the British are offering "extremely interesting financing" to get the Viscount launched in South America.

Viscount prospects got a boost in Brazil when the government bought two of them, one for President Juscelino Kubitschek and the other for the Air Minister.

Aerovias' Plans

REAL-Aerovias, Brazil's largest carrier and Varig's main competition, is taking a more conservative approach to equipment buying. REAL President Linneau Gomes says his company will order piston transports for its traffic needs until it makes the move to straight jet operations.

"We are going to stick with piston engines and standardization right up to the time we have to move into jets," Gomes said, adding that "turboprop planes are not for our airline." Gomes said the turboprop is only a temporary solution and "won't be here to stay when the jets come around."

REAL has ordered five DC-6Bs for its overseas routes and six Convair 440s for local services. The airline already has two 440s. The carrier is also buying a long-range DC-4 to add to the three it has now for its Brazil-Caracas-Miami-Chicago service. The DC-6Bs, which will be delivered in 1958, are needed for the route to the U. S. and for a new route to Tokyo which REAL plans.

REAL Studies Caravelle

REAL executives admit they are "too consumed with present problems" to think seriously about jets. But French engineers have prepared a study showing how the Ouest Caravelle would fit into REAL's plans, and the French are offering the turbojet transport for $1.8 million with "extremely good" pay-as-you-go terms.

REAL's officials told AVIATION WEEK that Ouest, Vickers and Convair are putting on the biggest sales push in Brazil. Convair recently started a study for REAL on the 880 turbojet transport.

REAL recently added Nacional to its system, giving the merged carrier a total of 108 aircraft, including 87 DC-3s. REAL feels piston engine transports will be used for another 10 or 15 years.

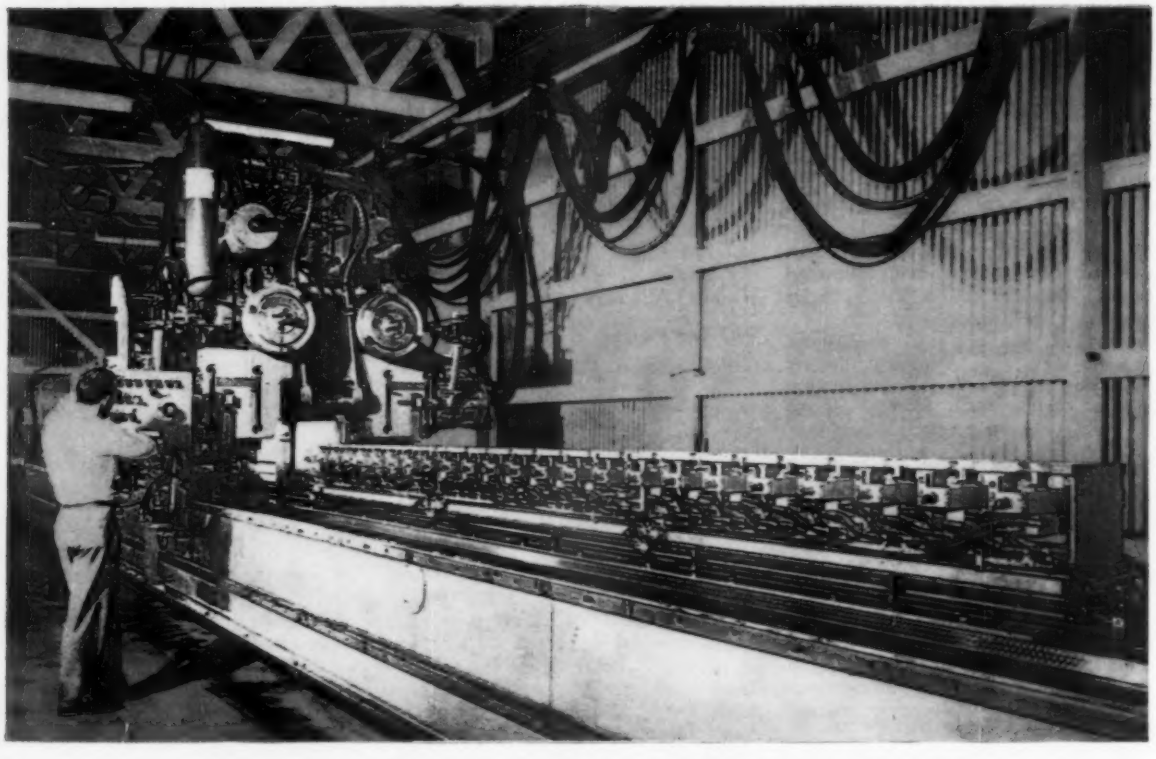
Engine standardization was one reason REAL chose the DC-6B, since it uses the same engines as the airline's Convairs. Another reason cited by a company official was "because we never heard of anybody losing money on that plane."

Dr. Eduardo M. Alvarenga, REAL's vice president for engineering and equipment, said his airline cannot afford to "experiment and speculate with turboprops," but has to order equipment "we know we can make money on."

Alvarenga also feels that Brazil's airfields will be a serious problem for turbine operation because of short runways.

Panair do Brasil is currently awaiting delivery of four DC-7Cs and is "re-equipping with a note of conservatism," according to equipment chief Capt. Roberto Souza Dantas. Earlier, Panair had an apparently long lead into the jet age with orders for the de Havilland Comet II, but when the Comet disasters occurred, the order was canceled. Now Panair plans to stick with piston transports for a while.

Dantas says the DC-7C is the only transport that can solve Panair's over-



FARNHAM 60-FOOT SPAR MILL – PART OF

ROHR'S MULTI-MILLION DOLLAR TOOL KIT

This great, modern machine at Rohr makes possible the precision machining taper and step cuts on large-scale longitudinal aircraft stringers, spar caps and struts.

With this and hundreds of other heavy manufacturing machines, Rohr produces over 30,000 different parts for aircraft of all types.

This is, of course, in addition to Rohr's being recognized as the world's largest producer of ready-to-install power packages for airplanes.

For design and engineering know-how, for full production facilities look to Rohr to build more into the aircraft parts you need.

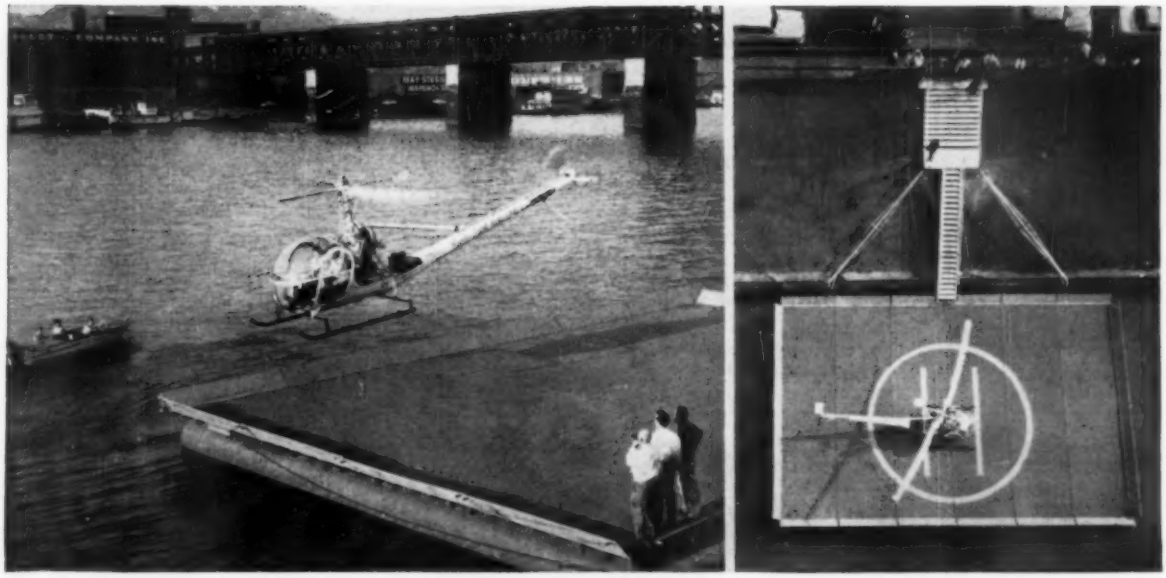
In addition to the Lockheed Super G Constellation shown here, Rohr builds power packages for many other leading commercial and military planes which have made Rohr famous as the

WORLD'S LARGEST PRODUCER OF READY-TO-INSTALL POWER PACKAGES FOR AIRPLANES

ROHR
AIRCRAFT CORPORATION

Excellent career openings now for engineers and skilled technicians.

PLANTS IN CHULA VISTA AND RIVERSIDE, CALIFORNIA; WINDER, GEORGIA; AUBURN, WASHINGTON



Portable Heliport

Pittsburgh's new portable heliport serves nearby towns, numerous steel, aluminum, glass plants in area. Located in Allegheny River near Ohio River confluence, heliport can be moved easily to any more advantageous spot on three major Pittsburgh waterways. Designed by R. D. Tufford and manufactured by Kenco, Inc., installation is operated by Industrial Helicopter, Inc. It was shipped to Pittsburgh on flat cars, unloaded by crane, assembled on bank of river, towed to anchorage. It is connected to bank by compensating stairway which permits rise and fall with level of river. Now in six sections, heliport can be expanded to meet increased traffic. Total operational area is 2,400 sq. ft. Flight deck is perforated embossed plate. Kenco, Inc., says effect of picket formations in deck is to stabilize rotor's downblast, resulting in decrease in power requirements on takeoff. Total cost of installation was $18,000 plus $3,000 for accessories.

seas route problem. The airline, which is 48% owned by Pan American World Airways, operates extremely long routes to Europe and the Middle East. In addition, the carrier has short and medium length routes in Brazil and longer routes to other South American countries.

Right now, Panair operates its overseas routes with a fleet of 11 L-49 Constellations, an obsolete aircraft in terms of present day competition. When the DC-7Cs are delivered, Panair plans to switch the Constellations to local routes and tourist services to other South American points.

According to Dantas, Panair needs an aircraft that can operate long-range flights now and be switched to local routes and low-fare services later. The DC-7C fits this pattern. In contrast, turboprops do not have enough range to operate across the South Atlantic, and the longer range jets are too heavy for Brazilian runways.

Cruzeiro do Sul's president, Dr. Jose Bento Ribeiro Dantas, has just returned from equipment shopping trips to the U. S. and Europe, and he favors turboprops to meet competition on coastal routes.

Cruzeiro has ordered 10 Frye Safaris for interior routes.

The prospects of a merger between Cruzeiro and Panair appear to be quite strong, and Dantas said such a merger, if it comes off, will "give us an enormous opportunity to economize and order new equipment."

Dantas looks for standardization on turboprop equipment as soon as possible, and he said "Vickers has the plane for us as far as quick delivery in turboprops is concerned."

Cruzeiro has $10 million to spend on new equipment, and apparently the money will go for Safaris, Viscounts and conversion of the airline's Convair 340s to turboprop power. Decisions on the program are now being made.

The Cruziero official was impressed by the Napier turboprop conversion being offered for Convairs at $300,000 each. He said any piston transports bought by the carrier will be Convairs so that they can be converted. Dantas said Napier also is working on a conversion for the L-49 Constellation which might interest Panair.

Loide Aereo Nacional is basically a cargo line that hauls passengers in mixed cargo-passenger transports. According to operating director Coronel Marcilio Gibson Jaques, the airline's main need is for "a plan so flexible it can bend."

Loide ordered four Viscounts two years ago, but canceled the order when the price doubled during the period the Brazilian government was getting around to granting permission for exchange allocations.

Since then, Loide has switched to the DC-6C, a DC-6A with a highly flexible cargo-passenger interior. The carrier will spend $5 million for four of the Douglas transports. Loide expects Export-Import Bank aid in financing the deal.

Airline Profits Trend Generally Is Upward

Airline earnings for the first nine months of 1956 generally increased, although Trans World Airlines showed a drop from 1955.

Net profit for Trans World for the period was $170,000 compared with $5,154,000 for the first nine months a year ago. The company said the difference resulted from heavy losses in the first quarter from installing additional maintenance and service facilities.

Net income of Western Air Lines, Inc., for the first three quarters was $2,095,689, a record for the company. This compared with earnings of $1,639,756 for the same period last year. Income included sale of planes retired from Western's fleet.

Net profit for third quarter of 1956 was $976,441, compared with 1955's third quarter profit of $887,937.

Western's fourth regular dividend of 20 cents a share will be paid on Nov. 15 to stockholders of record Nov. 1.

Other airlines reported:

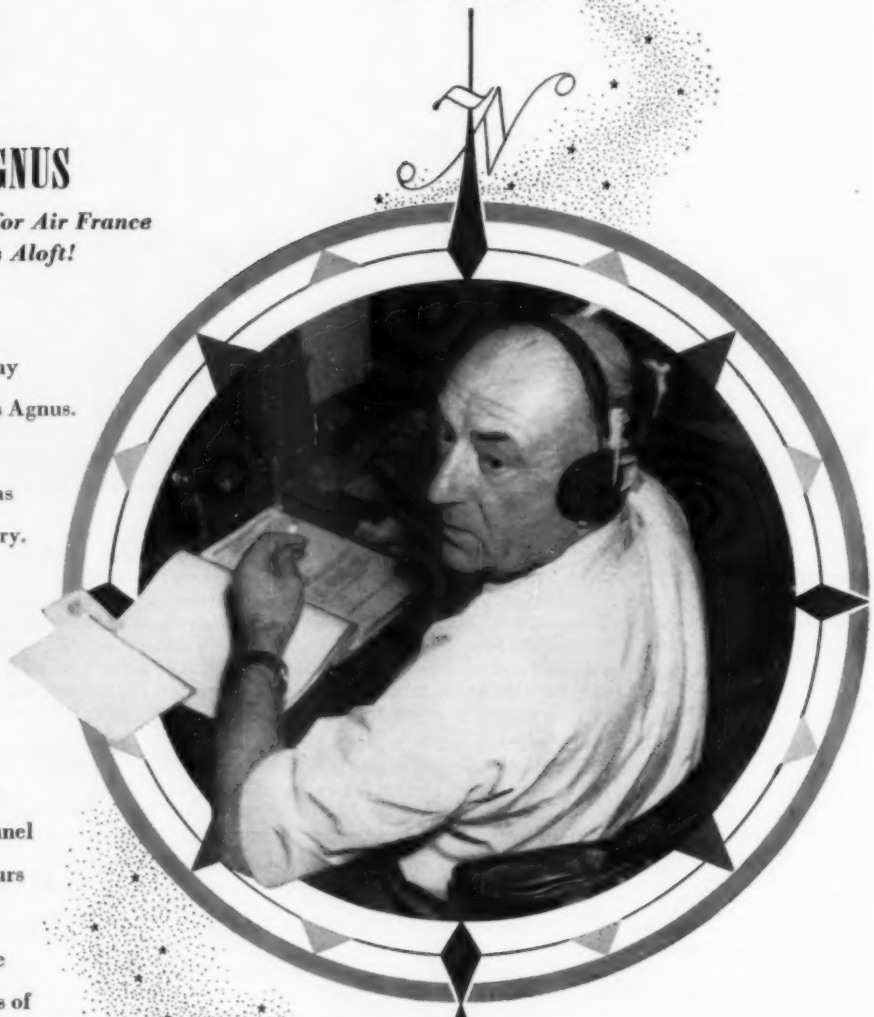
• **Slick Airways** showed a nine-months

The Men Who Are Air France

No. 3 OF A SERIES

LOUIS AGNUS

A Senior Navigator for Air France
21,000 Hours Aloft!



Aviation has come a long way since 1921—and so has Louis Agnus. As a flight engineer he has pioneered with such giants as Bossoutrot and Saint-Exupery. He was flying regular night service as long ago as 1926. His navigational skill has been tested by survey flights throughout the world—Louis Agnus is today among the elite flight personnel of the world, with 21,000 hours aloft to his credit. He has materially contributed to the Air France record of 37 years of dependable service to the peoples of 73 countries.

AIR FRANCE

THE WORLD'S LARGEST AIRLINE
WITH 177,740 UNDUPLICATED ROUTE MILES TO 236 CITIES IN 73 COUNTRIES

SEE YOUR TRAVEL AGENT, OR AIR FRANCE • New York • Atlanta • Boston
Chicago • Cleveland • Dallas • Detroit • Los Angeles • Miami • Philadelphia • Pittsburgh
San Francisco • Washington, D. C. • Mexico City • Montreal • Toronto • Vancouver • Havana
Puerto Rico • Fort de France • Pointe a Pitre • Panama • Caracas • Bogota

profit of $466,000, compared with a loss of $504,000 for the same period in 1955.

• **Continental Air Lines** had a net income of $630,041 in 1956 compared with $223,028 last year.

• **Japan Air Lines'** profit for the first half of its fiscal year, April through September, amounted to $1,214,000. The company said this was an increase of 43% over the previous six months.

Dividend payments included:

• **Flying Tiger Line** declared a semi-annual dividend of 25 cents per share on its 5% preferred stock payable Dec. 17 to stockholders of record Nov. 1.

• **Bell Aircraft Corp.** will pay a 75 cents a share dividend on common stock on Dec. 17 to stockholders of record Nov. 23.

Shortlines

► **Allegheny Airlines** will begin flying over its new Erie-Detroit route on Dec. 1, serving Detroit through Willow Run Airport. . . . Allegheny flew 6,395,547 passenger-miles last month, a 16% gain over the previous October.

► **Aerolineas Argentinas** has increased its Buenos Aires-New York service to two DC-6 flights a week.

► **British European Airways** now has permission from the Ministry of Transport and Civil Aviation to operate a London-Moscow service via Warsaw. However, the British carrier still lacks Russian permission.

► **Bulgaria's** TABSO will operate three flights a week this winter on its Belgrade-Sofia route, while YAT, the Yugoslav airline, will fly one round trip a week over the same route.

► **Canadian Pacific Airlines** says the addition of 10 Britannias and 10 DC-6Bs to its overseas fleet during the next 18 months will increase passenger capacity by 400%. Introduction of the Britannia on Canadian Pacific's polar route will cut Vancouver-Amsterdam flight time from 19 to 12 hours, and these additions to its fleet will allow the carrier to use DC-6Bs on its domestic system for the first time.

► **Convair Division** of General Dynamics has new orders for seven 440 Metropolitans, bringing the total to 125 aircraft. REAL S/A Transportes Aereos has ordered four. Karhumaki Airways, a Finnish carrier, has ordered one 440; Ansett Airways and the Italian Air Force have ordered one each.

► **Emery Air Freight Corp.** reports net income of $145,874 for the third quarter

AIRLINE OBSERVER

(EDITOR'S NOTE: *The following column was gathered during* AVIATION WEEK'S *coverage of the 14th Biennial Convention of the Air Line Pilots Assn. in Chicago.*)

► Pilots are forecasting a temporary decline in airline pilot employment during the transition from piston-engine aircraft to turboprop and turbojet equipment. They feel, however, that once jets are scheduled on a large scale, there will be a renewed expansion of job opportunities similar to increased employment created in 1949 by the introduction of DC-6s and Convairs.

► **Air Line Pilots Assn. will sponsor the first full fellowship in aeromedicine in U. S. ALPA fears there is too little experience in neuropsychiatry field of aviation medicine and feels pilots are often unfairly diagnosed in psychiatric problems because of a distorted impression by the public of pilots' physical and psychological requirements. Psychiatric ailments now rank as the chief cause of loss of license. Ohio State Medical Center also is showing interest in this field and is striving to establish Ohio State University as civil aviation medical center of the world.**

► Pilots will negotiate with airline managements for an increase in group term insurance at company expense to offset the decrease in purchasing power of dollar during past 15 years. They also will seek to obtain minimum company-paid group insurance of $10,000 for first officers and $15,000 for captains.

► **Switch from present equipment to jet transports will not be as rapid as change-over from DC-3s and DC-4s to DC-6s and Convairs because few airports will be able to accommodate new aircraft, and many cities will be unable to support them economically, according to one ALPA committee study.**

► Wylie Drummond, American Airlines' pilot who campaigned vigorously as the only real contender to Clarence Sayen's hold on the ALPA presidency, withdrew from the race before elections were held on the convention floor. Although Sayen conducted no personal campaign during the seven-day convention, his backing remained generally strong throughout the eight-day meeting, and there was never serious doubt about his re-election.

► **Total of 306 first pilots earned more than $20,000 in 1955 exclusive of pension plans; 281 copilots topped $12,000 during the same period. Average salary for all ALPA pilots last year was $12,300, with first pilots averaging $15,361, copilots $9,020. First pilots on the Big Four airlines averaged $16,225, and first pilots on wholly international airlines earned an average $17,394 during the year.**

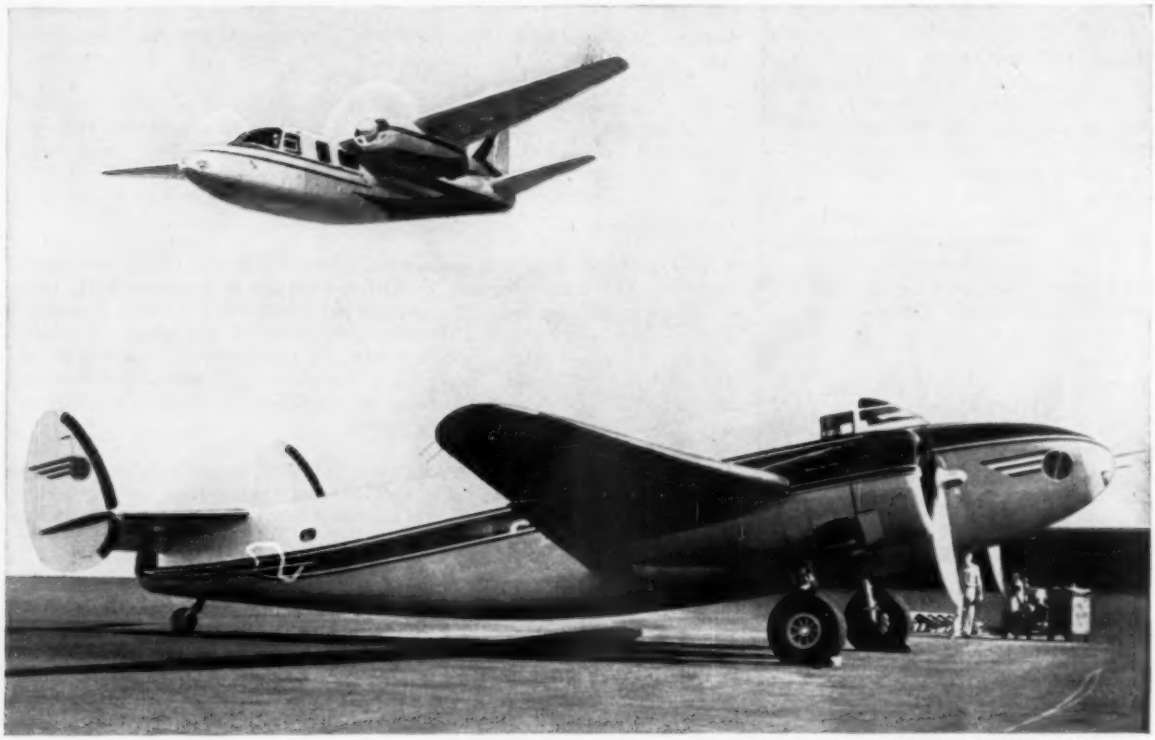
► ALPA will not recognize a compulsory retirement age for pilots unless it is backed by valid statistical data. According to an ALPA study, no such substantial facts are available and the generally accepted retirement age of 60 is an arbitrary choice without foundation. Currently, there are 21 active airline pilots over 60 and 3,000 over 40.

► **Ground and air training courses on all types of aircraft will be made available to ALPA members. The association may establish its own school to provide home study courses for pilots on jet propulsion and operation of jet aircraft.**

► ALPA's active membership totaled 10,914 as of October 1956, an increase of 1,133 since the previous October. Forty-seven airlines are represented in the organization.

► **Recommendations will be made to Civil Aeronautics Board by ALPA for a tightening of regulations covering transportation of potentially dangerous cargo aboard scheduled aircraft. Studies will be conducted by the association to determine the best means of identifying such material so that pilot in command will be aware of its presence aboard.**

Important news for all corporate and private flyers...



Aero Commander 560 and Learstar

A new development for **all** types of aircraft engines

Here's a new detergent-type oil *that's good for all types of aircraft engines*—horizontally opposed, inline or radial! It keeps all kinds of aircraft engines cleaner than was ever possible before with non-detergent oils . . . *without* developing any undesirable side effects.

The secret? New Gulfpride Aviation Series D combines Gulf's exclusive Alchlor Refining with a remarkable new "detergent additive."

Cleaner Engines

Experience in all kinds of service proves New Series D greatly *reduces carbon, coke and varnish collection* around rings and valve stems. *Eliminates harmful deposits* in the combustion chambers.

More hours between overhauls

New Series D offers you an unusually tough lubrication film, too. *Cuts down wear on engine parts substantially.* The result? Far lower *operating* and *maintenance* costs! Safer *engine performance!* Why not try it and see for yourself?

NEW GULFPRIDE AVIATION

GULF

AVIATION PRODUCTS

SERIES D

as compared with $111,276 for the same quarter of 1955. Revenues rose from $1,961,944 to $2,345,626 in the same period. Net income for the first nine months was $361,639 this year and $239,544 last year.

▶ **KLM Royal Dutch Airlines'** passenger traffic was up 10% in the third quarter over the same period last year. Freight traffic rose 21% in the same period.

▶ **Lockheed Aircraft Service** will open a new base at Honolulu International Airport in January. Operating under a contract with the Navy, LAS will provide maintenance for Super Constellation-type aircraft operated by the Navy's Airborne Early Warning Wing.

▶ **National Airlines** has ordered four 1049H Super Constellations equipped with weather radar. Delivery is scheduled to begin in August 1957.

▶ **Northwest Airlines** has Civil Aeronautics Administration approval to increase overhaul time on R3350 engines from 1,200 to 1,300 hours. Northwest previously extended the overhaul time for R4360 engines to 1,300 hours.

▶ **Western Air Lines** will equip its fleet of DC-6Bs now in service, as well as DC-6Bs and Lockheed Electras on order, with Bendix RDR-1B X-Band weather radar. The program will cost about $700,000.

Univac Computer Ordered by Capital

Capital Airlines has ordered a Remington-Rand Univac File Computer to speed the handling of its system reservations. Initially the Univac will replace the individual space charts in Capital's central space control office in Washington upon which sales are now recorded manually.

Sales made in the field will come into Capital's Washington center over private line telephone circuits and automatically be recorded on tape recorders. These will be played back to operators who will enter the sales in Univac by means of a small keyboard.

When a trip reaches a stop-sale condition, the computer will automatically cause a teletypewriter to cut a teletype message which will go out to all stations advising the change in status for that flight.

In the second phase of its program, Capital plans to install agent handsets at each reservation and ticket office in the system. This will permit automatic and instantaneous inventory control and reporting of available space, similar to the operation of American Airlines' Reservisor.

COCKPIT VIEWPOINT

By Capt. R. C. Robson

Correction Means Action

Despite the existence of a high level air traffic control committee and plans for the coming years, the aeronautical forecast for this winter might well read:

"Increasing delays due to saturated air, continued communications confusion and occasional traffic catastrophe."

This outlook may sound gloomy, but many people believe it is accurate. Lengthy committee studies and detailed reports are not going to solve existing problems soon enough. Someplace we are going to have to get action.

Long-range Planning

It is true that aviation needs long-range planning. It is also true that we need detailed committee reports. But more than anything else we need immediate action on present conditions. We need people armed with authority to do things.

For instance. As previously reported in this column, some centers, like Washington, do not have radio coverage to the extremities of their control area.

The situation does not need an evaluation—it needs action. The antenna site may be wrong, the antenna may not be high enough, the radio equipment may need more power, any of a number of things may be wrong. The correction is simply to fix it.

For instance. Some centers, again like Washington, have more than one frequency wired into a receiver—so the controller receives hash instead of position reports. The correction: buy another receiver.

For instance. Some centers, like New York, are so short of controllers that one man must monitor several frequencies. This results in continued interruption of position reports. The correction for this is to get more controllers. Where? From another center or tower where they are not so badly needed. This is exactly what any corporation does—it moves people to areas where work exists.

For instance. There are many unnecessary position reports. This clutters up the airwaves. In fact the New York center cannot handle all the reports it requires.

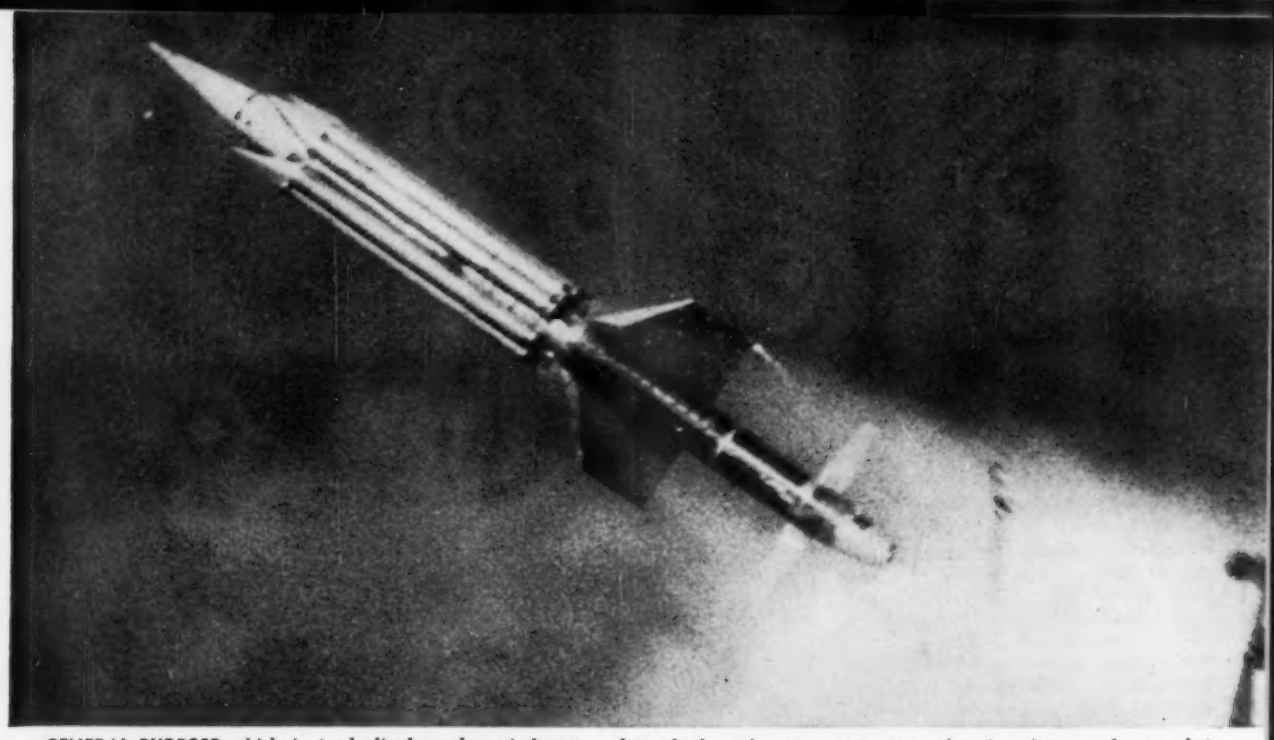
The fix is simply to eliminate the less essential reports.

For instance. Present radio-telephone language takes up too much time. We have now arrived at the point where each syllable is important. The old Alphonse and Gaston routine won't work any more. The fix is to revise the procedure.

Complete Overhauling

It is certainly true that the basis of present traffic control methods needs complete overhauling and that the items mentioned here are merely small improvements in the existing system. But let us not keep dreaming about the age of automation in aviation and ignore the situation at hand. We can plan ahead, we can design for the future, we can invent new gadgets. But what about the winter?

And next? Until we get some sort of a vigilante committee, armed with the power to do things, staffed with operation people who know what to do to make the necessary fixes, that aeronautical forecast is going to get increasingly worse.



GENERAL PURPOSE vehicle is standardized aerodynamic layout used to check performance parameters of various items such as rocket motors or guidance equipment. Rounds are built by Short Bros. and Harland in Belfast.

Britain Holds First Aberporth Test Show

Aberporth, Wales—Four test firings of some of Britain's developmental missiles and their test vehicles were featured at the first showing of the guided missile test range here.

None of the missiles demonstrated could be considered as an operational weapon in truly developed form.

In contrast to recent United States exhibitions of Army and Air Force missiles, none of the test rounds could be examined before the firings. Security, a mound of earth, distance and the gathering darkness screened from view the details of missiles and launchers.

First scheduled demonstration was a test firing of two Fairey Fireflash air-to-air missiles, an interim training weapon for Fighter Command. They are standard armament on the Vickers Supermarine Swift F.7.

The Fireflash, first British missile to shoot down a target aircraft, is being built in service-test quantities. It has no motor of its own, but is boosted by a pair of solid-fuel rocket motors which straddle the missile well forward of its nose. Guidance system is a beam rider with the directing beam coming from the launching plane.

Fireflash itself is 7.5 ft. long and has a six-inch diameter.

Test airplane for the launching was a service Hawker Hunter from Fighter Command. The pilot made a first run at low level 50 ft. above the observers heads. They were standing on a 450-ft. cliff and the test called for a 500-ft. altitude at launch. The second run was made at Mach 0.9, and the firing was done directly over the observers.

Only one round fired; the pilot radioed to say that he would jettison the second on his next run. This was done.

At separation the missile and boosters whipped underneath the fuselage at a fairly high transverse speed.

Immediately the pilot went into a series of rolls, described both as an expression of relief and as part of the jettisoning routine.

Clausen Platform

Second firing, seen from a distance, was that of an Armstrong-Whitworth rocket test vehicle from the Clausen rolling platform, familiarly known here as HMS Rock 'n' Roll. The platform is actually a small ship floating in a basin at the water's edge; it is compartmented for simulation of shipboard conditions below decks. Deeper compartments can be flooded to change the response characteristics of the platform in pitch and roll. It can pitch up to 10 degrees and roll up to 20 degrees.

The A-W missile was described as being a dummy round simulating a missile under development for the Royal Navy. It was of a simple wingless body-fin configuration and was boosted with a trio of rockets. After separation, the missile flew ballistically to impact off-shore.

A Bristol ramjet test vehicle was demonstrated next, also from a distance and behind an earth mound. It was a twin-ramjet configuration, with engines mounted at the tips of a short horizontal surface, similar to a vehicle shown by Bristol at the SBAC display at Farnborough four years ago.

Four boosters accelerated the Bristol round to speed and then separated. The ramjets fired and continued to burn for 100 seconds, when the missile was destroyed to keep within the range limits.

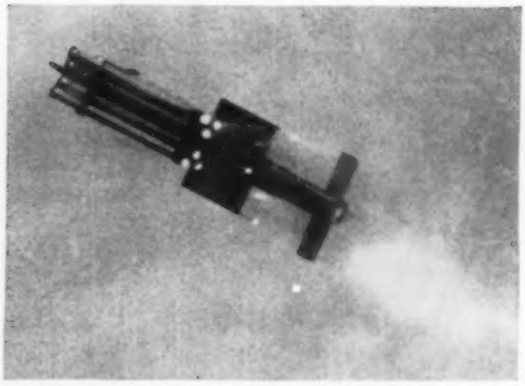
Final firing was an English Electric test vehicle. Actual launching took place after sunset, which prevented any detailed observation of the vehicle itself. English Electric has a production contract for a ground-to-air weapon similar to an earlier test vehicle of approximately 20-ft. length and 15-in. dia. Trapezoidal wings and tail surfaces characterize the layout.

Missiles and Missions

Chief function of the Ministry of Supply's Royal Aircraft Establishment at Aberporth is that of a contractor service range. It provides common facilities for testing and development of short-range surface-to-air and air-to-air missiles. In this respect the range mission parallels those of the U. S. Air Force Missile Test Center and the

MISSILE ENGINEERING

HTP FOR RTV: Concentrated hydrogen peroxide is being loaded into this rocket motor test vehicle at RAE Aberporth. Wings are trapezoidal shape with truncated diamond airfoil sections. Control surfaces are of high aspect ratio and are all-movable. Eight booster rockets are used, paired in four assemblies each having a shaped nose section and canted rocket nozzles to produce positive separation at burnout.



MOTOR TEST is carried out with this vehicle, boosted by a dozen cordite rockets of four units of three rockets each. Canted nozzles guarantee separation at burnout. Cruciform lift and control surfaces are rectangular planform, with the controls having a higher aspect ratio. Flares are used at each of the four wingtips for visual tracking.

U. S. Army's White Sands Proving Ground.

The small size of the British Isles and the proximity of the Aberporth range to any aircraft factory are time-saving advantages. Air-to-air missiles can be installed at the factory on the airplane to do the test firings, and flown under Aberporth control and scheduling over the range area for the firing tests. Thus no major air strip and hangar facilities are needed.

Aberporth Geography

Surface-launched missiles are sent to Aberporth for final assembly and preparation for firing. Pre-launch tests are made in the usual manner.

The geographical layout of the guided missile range at Aberporth is reminiscent of the German test site of World War II at Peenemuende. Aberporth is on one arm of the land enclosing Cardigan Bay on the coast of Wales. Firings are made roughly parallel to the shoreline and the instrumentation stations are along the shore for easy and accurate observations.

Standard surveillance techniques protect the limited amount of shipping in Cardigan Bay and monitor surface and air traffic during firings. The geographical range limit is 80,000 yds. set by the Caernarvon Peninsula to the North; test rounds are kept well short of that limit.

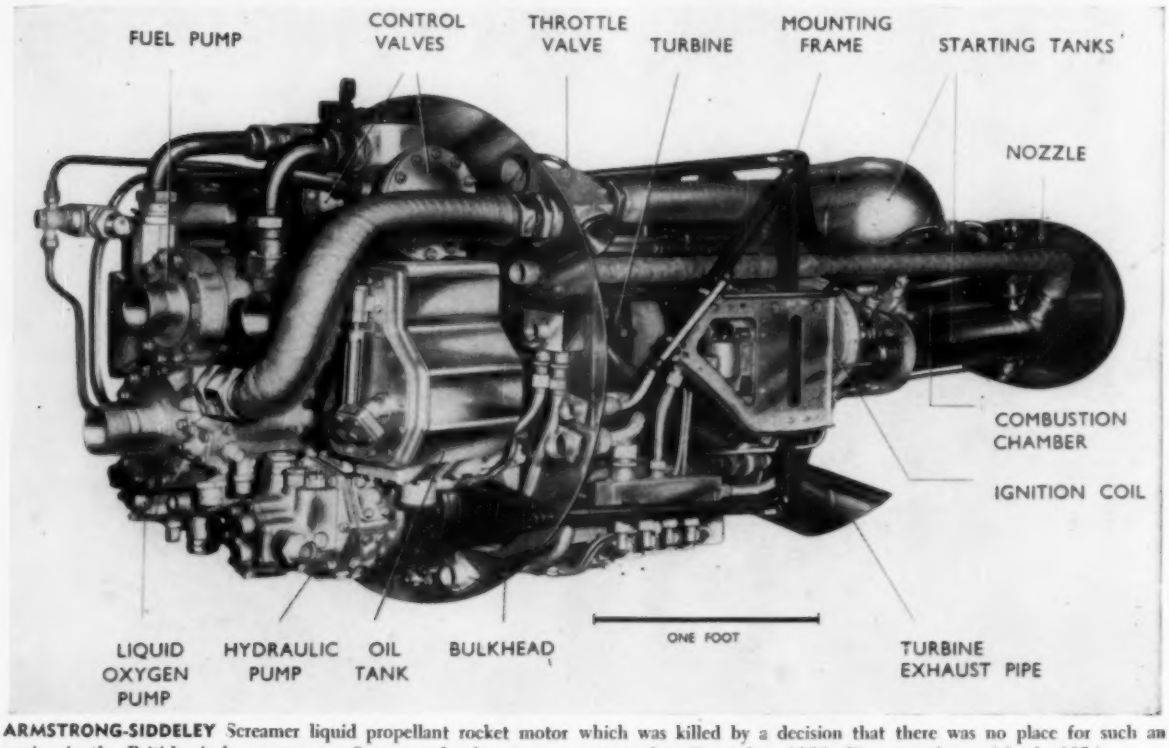
Radar and doppler sites and cine-theodolite stations are tied in to the master control building at Aberporth by land lines. A master timing signal for the range is sent out from the control building to all tracking sites.

Drone aircraft for anti-aircraft or air-to-air firings are flown from Landbedr near the northern range limit. Near the range Aberporth control takes over and flies the drone in the test pattern.

Miss-distance recording equipment—generally photographic—is used extensively to avoid ruining the target. After firing, the target is returned to Landbedr and landed under that station's control.

Current firing programs at Aberporth total about 1,000 rounds per year, exclusive of the simple sighting rounds fired to determine cloud bases or to calibrate range instrumentation.

RAMJET VEHICLE blasting off launcher is boosted to speed by four solid-propellant rockets. Simple pitot type of nose inlet indicates that engine operates best below Mach 2. Ramjet is a Napier design, flies a zero-lift trajectory under power after booster separation.



ARMSTRONG-SIDDELEY Screamer liquid propellant rocket motor which was killed by a decision that there was no place for such an engine in the British airplane program. Screamer development was stopped in December, 1955. First runs began March, 1954.

Successful British Rocket Motor Killed

By David A. Anderton

A throttleable rocket engine burning jet fuel and liquid oxygen passed its flight clearance test at continuously variable thrust ratings from 800 to 8,000 lb. in Britain last year.

But the successful project was killed by a decision that there was no application for a liquid oxygen rocket motor for use in a piloted airplane.

The motor was the Armstrong-Siddeley Screamer. The decision to kill it was made in the face of Britain's lack of rocket-powered research aircraft and the tremendous backlog of U.S. experience with liquid oxygen motors in piloted planes.

The powerplant had accumulated more than 35 hr. of running time in more than 1,300 firings. It could be stopped and started in any attitude and at any altitude. It had shown dependable and consistent operation. It had beaten the schedule established for it by an easy margin of six months.

Its history parallels in final frustration the British attempts to get high-speed flight data by dropping instrumented models of a proposed supersonic aircraft (AW Jan. 31, 1955, p. 28). Those airplane model tests, abandoned in 1948 when transonic test data in Britain was very limited, showed little progress. But the models were advanced in design concept and had, among other features, all-movable tails. If the tests had been carried through, the value of the all-movable tail might have been found out by the British in a much easier fashion than actually happened. The slab tail is new to British aircraft even now.

Controlled Thrust

The Screamer powerplant is built around a single combustion chamber and is controlled by varying the propellant flow. The original specifications of June 1952 called for a completely self-contained powerplant using its own prime mover for propellant feed.

The Armstrong-Siddeley rocket division engineers under chief engineer Sidney Allen faced three problems as a direct result of the specifications:

• **Thrust range from 800 to 8,000 lb.** Propellant flow rate was to be throttled to produce the thrust variation. The basic decision was whether or not to use multiple combustion chambers to get step-thrust changes. Analysis indicated the main loss would be due to combustion inefficiency; gas turbine experience convinced the rocket engineers that this was not a major problem and so they decided upon a single combustion chamber.

• **Turbopump design,** using propellants as prime movers. Traditional power for turbopump drives in rocket engines has been the decomposition of concentrated hydrogen peroxide. But the logistics of supply for another fluid strange to routine channels worked against the choice of peroxide. Final choice was to provide a small combustion area of kerosene and liquid oxygen whose exhaust was diluted with water to produce superheated steam.

• **Starting safety and reliability problems.** Safety in starting was to be worth any extra complications in design. The engineers chose an ignition system proven on the company's earlier Snarler rocket. An igniter tube is used to start the fire under conditions that would be safe if the propellants failed to ignite. After pre-ignition, a sequenced operation fired the chamber.

Screamer Layout

Final construction of the Screamer produced a powerplant package about 28 in. diameter and 78 in. long. Dry weight was 470 lb. For comparison, the

6,000-lb. thrust Reaction Motors four-chamber unit weighs 210 lb.

The final design, like others everywhere, was arrived at after other designs had been tried and abandoned. The original plan for the Screamer called for conventional regenerative chambers with fuel used as a coolant in helical passages through the shell.

Characteristic length (volume of the chamber divided by the nozzle throat area) of the motor was 60 in. Injection was done by a series of impinging jets in the motor head.

Film Cooling

Early tests showed the need for film cooling at the throat; otherwise the throat kept eroding. Construction of the shell wasn't readily adaptable to film cooling, so the engineers redesigned the motor, using a series of aluminum alloy hoops drilled and dowelled together.

Kerosene as a coolant left something to be desired. There was water available as part of the turbopump system, and the engineers much preferred to use it as a coolant. Further, if it were injected into the combusion chamber after cooling the motor, the water also became a propellant. The mixture of water, kerosene and liquid oxygen gave a specific impulse only a few seconds lower than the best mixture of kerosene and oxygen.

The use of water as a motor coolant was regarded as a temporary step, and was intended to shorten the development cycle.

Meantime, tests which reached the 6,000-lb. thrust level showed engineers that the hoop motor had its drawbacks. They changed to a second combustion chamber, called a throatless type, which had been tried on the Snarler.

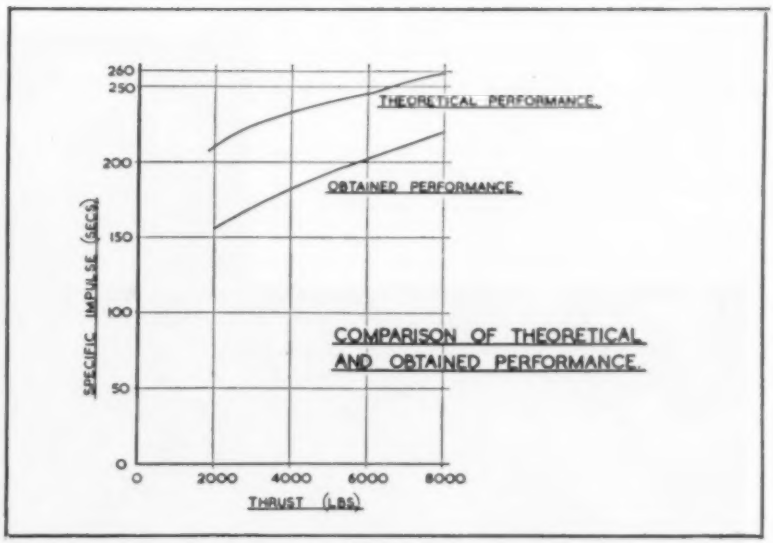
At that time they also gave up trying to drill holes in a solid injector head, because of the abnormally high amount of work involved.

Further if a drill broke near the end of the drilling process, the whole head had to be scrapped. Final choice was a machined head using inserted rings containing the injector holes and brazed into position.

The injection scheme finally chosen after many tests was the "like-on-like" where similar jets impinge at the head system.

Screamer Operations

First step in operation of the Screamer was to get the turbopump drive to operating speed. This was done by feeding propellants to the gas generator from small pressurized tanks. These tanks were designed to vent and refill automatically after each start to accommodate an indefinite number of starts during one sortie. Water and fuel tanks used an internal bag to force-



GRAPH SHOWING theoretical vs. obtained performance. On test stand, thrust got up over 8,000 lb. for a total of three hours. Highest thrust was 8,900 lb.

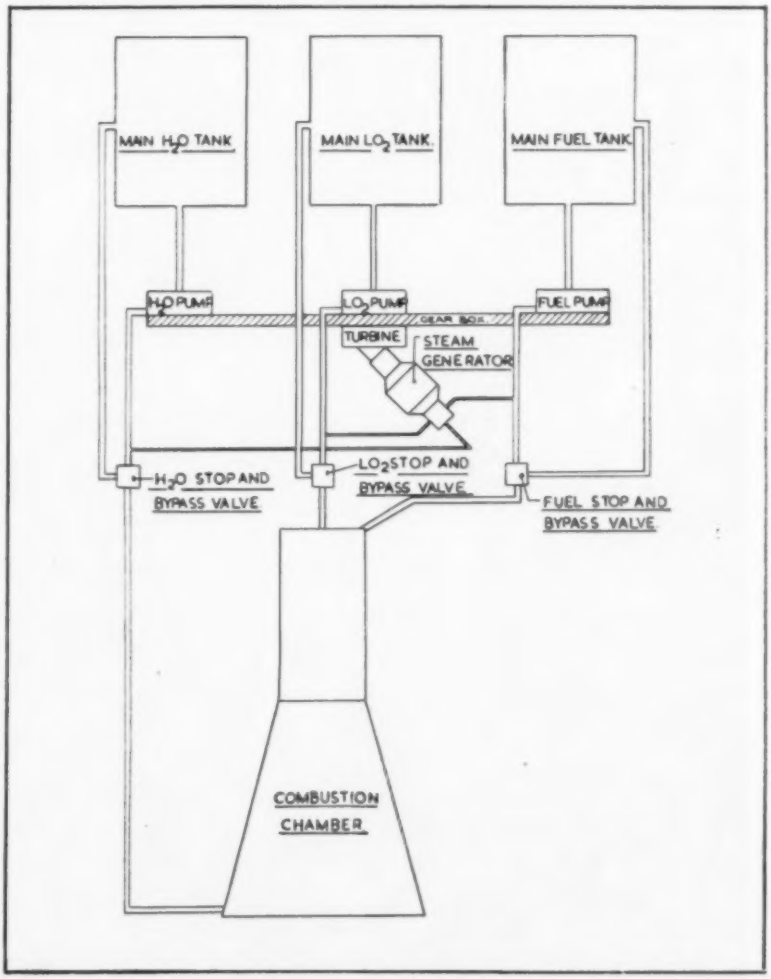
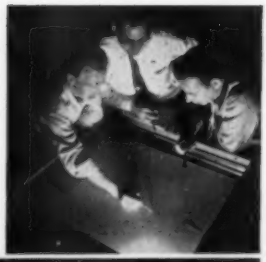


DIAGRAM of fuel system. Steam from generator starts turbines and pumps prime and deliver propellants to tanks through bypass valves.

In the photo at right, Lockheed Missile Systems Division data processing technicians are watching the "heartbeat" of a "bird" in flight—a graph-tracing being made by an automatic plotter.

Photo below: Two Missile Systems Division technicians are preparing to mount a Lockheed-developed telemetering antenna of advanced design (so secret it is shrouded to conceal its configuration) atop a pylon at dusk. Only after dark is the antenna unwrapped for tests to determine its radiation pattern characteristics.



HEARTBEAT OF A BIRD IN SUPERSONIC FLIGHT

...a vital phase in the critical race to develop a 5,000-mile Inter-Continental Ballistic Missile.

Today's thermonuclear missiles are the most complex and awesome mechanisms ever devised by man—and flight-testing them is of top-priority importance to continued U. S. leadership in missile systems technology.

Highly instrumented, each test "bird" during flight electronically transmits a staccato stream of data about its altitude, speed, aerodynamic behavior, reaction to extremes of atmospheric cold and air-friction heating, and other desired technical information—which is recorded on magnetic tape at the field test site, for later translation and analysis.

Lessons learned from missile flight-tests add cumulative knowledge to the state-of-the-art, and hasten the day when America will possess an ICBM able to deliver a nuclear war-head to any target on earth in minutes.

Missile testing is just one of the vital research and development projects to which more than 5,000 scientists, engineers and technicians are dedicated at Lockheed's Missile Systems Division, Van Nuys, California.

At Palo Alto, California, two new research laboratories have just been completed in world-famed Stanford University's industrial park area—and two additional laboratories are now being built. Only 8 miles away, at Sunnyvale, extensive new engineering and manufacturing facilities are under construction on a 275-acre site—all part of the $12,000,000 expansion program necessitated by the swift progress of Lockheed's Missile Systems Division.

Lockheed's Advanced Study Program helps outstanding students achieve Master of Science degrees in Mathematics, Engineering, Aeronautics, and other physical sciences. Write:

LOCKHEED

MISSILE SYSTEMS DIVISION

Van Nuys, Palo Alto, Sunnyvale, Calif.

feed the propellants, but the oxygen tank was a piston type.

By controlling the flow of propellants to the generator, the speed of the turbine was varied. This in turn varied the thrust.

To start the engine, the pilot simply moved the throttle lever from stop to any position between minimum and maximum thrust. The engine control system did the rest.

Moving the throttle opened the suction valves, pressurized the starting tanks and switched on the spark plugs in the gas generator igniter. Water from the starting tanks goes to the gas generator; its pressure at the generator operates the igniter fuel and oxygen valves and ignition takes place. If not, the whole operation is cancelled after two seconds by a time switch.

Combustion pressure in the igniter operates the gas generator main fuel and oxygen stop valves; water is already flowing from the starting tank. The same pressure cuts out the igniter timing circuit and transfers the spark generator circuit to the combustion chamber igniter.

Steam from the gas generator starts the turbines and the pumps prime and deliver propellants to the tanks through the bypass valves. Water pressure again operates the main chamber igniter stop valves and the main water stop valve. The resulting pressure downstream opens the main oxygen valve and the main fuel valve in sequence.

Combustion starts in the main chamber. The pressure vents the starting tanks which refill and cut off the ignition circuit.

This whole sequence, complicated as it sounds, takes place within three seconds after motion of the throttle.

Screamer Tests

First runs on the engine began in March 1954. With no airborne test experience to draw on, the engineers decided to get the Screamer into the air as soon as possible. They had a Gloster Meteor Mk. 8 as a flying test bed.

The engine had to be reworked somewhat to fit the Meteor and to avoid burning off the tail of the plane. There was not too much rework needed on the plane other than in the specific area of the installation. The liquid oxygen tank was carried in a ventral position and was made to be jettisoned in case of a wheels-up landing.

The Flight Clearance Test was passed at the first try in December 1955.

The test comprised 62 runs of 94 minutes total time, including stopping the engine by cutting off each propellant in turn, and attempting to start with no ignition, followed immediately by a normal start.

While the flight engine was being readied, another test bed was being used for Screamer development. On that stand, the engine thrust got up over 8,000 lb. for a total of three hours time. Highest thrust obtained was 8,900 lb.

In addition, some progress had also been made towards runs without cooling water.

The Screamer development was stopped in December 1955. Basis for the stoppage was a decision by the services that liquid oxygen rocket engines shouldn't be used, purely on operational considerations. Major worry was with the high rate of evaporation.

Fluorine Performance Calculated by NACA

The performance of liquid fluorine, its mixtures and compounds used as oxidizers in bi-propellant rocket motors, has been calculated by the National Advisory Committee for Aeronautics.

Assuming equilibrium composition during expansion, NACA scientists compared the fuel specific impulses obtained for chamber pressures of 300 psia. and exit pressure of one atmosphere.

The calculations showed these values of specific impulse, in seconds:

THE MODERN AIRPLANE
Requires for Reliability
MULTI-DIRECTIONAL
Engineered Mounting Systems
Combining
Vibration and Shock Control

Robinson Engineered all-metal shock and vibration control systems are preferred by the aviation industry. They provide performance, reliability and life to electronic equipment in commercial airplanes, jet aircraft, guided missiles and rockets.

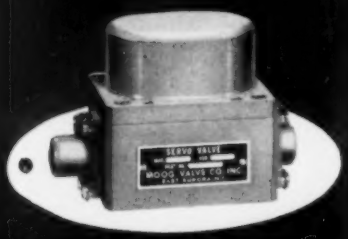
ROBINSON
ENVIRONMENTAL IMPROVEMENT through ENGINEERING
MECHANICAL-RUBBER

VIBRATION CONTROL IS RELIABILITY CONTROL

ROBINSON AVIATION INC.
TETERBORO, NEW JERSEY
Vibration Control Engineers
AIRBORNE DIVISION

WEST COAST ENGINEERING OFFICE: 3006 WILSHIRE BLVD., SANTA MONICA, CALIF.

MOOG
Servo Valves
Deliver
High Dynamic
Performance



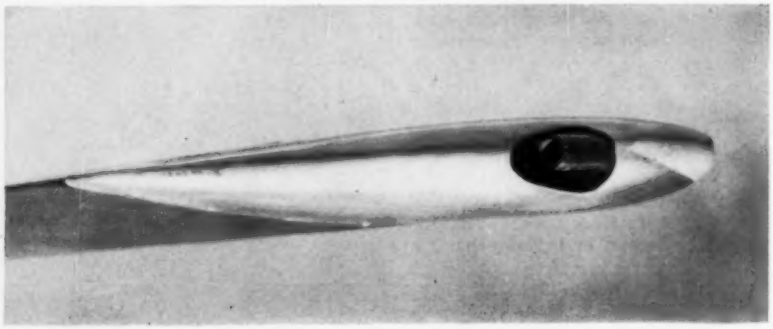
Type . . . 4-way proportional, electro-hydraulic
Equivalent Time Constant . . . as low as 1⅛ milliseconds
Output Flows . . . 0.1 to 50.0 GPM
Control Currents . . . 2.0 to 40.0 milliamperes
Pressures . . . 1000 to 3000 PSI
Weight . . . as low as 11 ozs.
Maximum Dimensions . . . as low as 3.1" x 2.1" x 1.9"

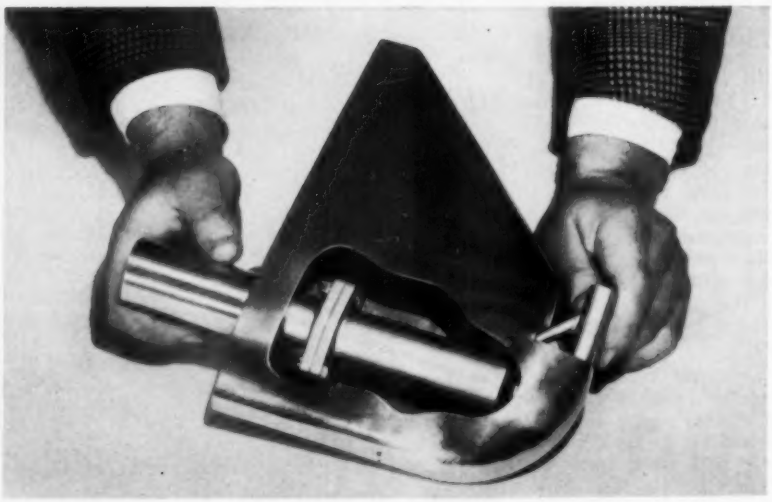
MOOG

MOOG VALVE CO., INC.
EAST AURORA, N. Y.

Napier Tip Thrust

New Napier rotor-tip thrust units shown on Saunders Roe Skeeter light helicopter use High Test Peroxide (HTP) as a propellant. Units (below) are designed in a range of five sizes, smallest weighing only 1.04 lb., giving a maximum sea-level thrust of 25 lb. Each unit consists of a catalytic steam generator for decomposing the HTP, a curved exhaust chamber and a nozzle through which the HTP steam is ejected at high velocity. One unit is installed in each rotor blade tip and the hydrogen peroxide is stored in a rotating tank above the rotor hub. Propellant is pumped along blades to tip by centrifugal action. Electrically initiated system controls response. Units were developed by Napier Flight Development Establishment, Luton, England, in cooperation with Saunders Roe, Ltd. Napier says units can be installed on any helicopter within short time; that little development work is required.





COOL COMMANDER!

Harrison Cools Aero Design's Ultra-Modern Executive Transport!

New ideas in the sky . . . a new concept in airway travel! That's what this sleek, ultra-modern Aero Commander represents. It's fleet, maneuverable, comfortable . . . the ideal way to get there and *get there fast* for the modern business man. And it's Harrison that gets the cooling call on this popular new executive transport. Beating the heat for the most advanced aircraft is a Harrison specialty. It requires engineering skill, production know-how and the research facilities that you'll only find at Harrison. So remember . . . if you have a cooling problem, look to Harrison for the answer.

HARRISON RADIATOR DIVISION, GENERAL MOTORS CORP., LOCKPORT, N. Y.

Lightweight, heavy-duty Harrison oil cooler is in command of heat on the advanced Aero Commander.

GM GENERAL MOTORS

Watch "WIDE, WIDE WORLD" Sundays on NBC-TV

TEMPERATURES MADE TO ORDER

HARRISON

a giant's grip ... that's feather light!

If great strength plus extreme lightness are your aircraft design goals, you should be utilizing the advanced engineering, chemistry and production know-how that have made Metlbond* structural adhesives the standard of reliability throughout the aircraft industry.

More than a decade ago, Narmco pioneered aircraft adhesive bonding—a design revolution that has since enabled engineers to build unparalleled strength and performance into structural components by the very nature of this uniquely efficient fastening method. Today, Narmco's accumulated skills stand behind a distinguished line of custom-developed adhesives, including Metlbond* 302, a multi-purpose supported adhesive designed for metal-to-metal and sandwich applications requiring prolonged temperature integrity to 500° F.

Send today for Narmco's illustrated brochure on Metlbond 302 ... a wealth of structural bonding design information.

Narmco technical field representatives throughout the United States and Canada, can assist in solving your structural design problems quickly, efficiently and economically. For immediate assistance, write, wire or telephone.

Metlbond 302 offers exceptional "handability." It drapes easily to drastic contours at room temperature, has excellent storage life and requires no priming, thus saving fabrication time and tooling costs. Because of excellent flow properties, Metlbond 302 requires low curing pressures (10 to 25 p.s.i.) and no post-cure. In sandwich applications, core materials need not be coated or perforated.

Metlbond 302 exhibits remarkably uniform performance properties over a wide temperature range, and is highly resistant to aircraft fuels, salt spray, and other corrosive chemicals. Available in five standard thicknesses ranging from .007 to .025 inch.

NARMCO

*Trade Mark Registered

NARMCO RESINS & COATINGS COMPANY, DEPT. 741—600 Victoria Street, Costa Mesa, California

- 364.6 for liquid fluorine and liquid hydrogen.
- 335.0 for liquid fluorine and liquid lithium.
- 315.3 for liquid fluorine and liquid hydrazine.
- 313.6 for liquid fluorine and a mixture of 36.3% liquid ammonia and 63.7% hydrazine.
- 311.5 for liquid fluorine and liquid ammonia.
- 299.4 for a mixture of liquid fluorine and liquid oxygen as oxidizer and JP-4 as fuel.
- 298.7 for liquid oxygen bifluoride and hydrazine.
- 295.8 for liquid oxygen bifluoride with a mixture of 36.3% liquid ammonia and 63.7% hydrazine.
- 291.6 for liquid oxygen bifluoride with liquid ammonia.

For comparison, the standard combination of liquid oxygen with either ethyl or methyl alcohol has a theoretical specific impulse under 250.

Germans Form Air Technical Committee

Bonn—Technical committee of the association of German Aircraft Industry has been founded. The members of the committee are:

Prof. Walter Blume as chairman and section head for aircraft frame construction; Helmut Sachse (BMW), as deputy chairman and section head for aircraft engine construction; Wilhelm Bansemir (Weser-Flugzeugbau); Peter Dornier (Dornier); Siegfried Guenter (Heinkel AG.); Hermann Pohlmann (Hamburger Fahrzeugbau); Dr. Hans Scherenberg (Daimler-Benz); Karl Schwaerzler (Heinkel AG.), and Prof. Karl Thalau (Messerschmitt).

Sycamore to Act as Rotor Icing Test Bed

A British Bristol Sycamore helicopter will act as a flying test bed during a series of extensive tests on rotor blade de-icing equipment. The tests are to be made at the National Aeronautical Establishment at Ottawa to evaluate under actual flying conditions the performance of the Goodyear de-icing equipment under consideration for the Bristol 192 twin-engined, tandem rotor helicopter on order for the RAF.

For test purposes, the Sycamore has been fitted with a cyclic electrical power system which operates a series of thermal-electric mats, extending along the leading edge of the outer two-thirds of the main rotor blades. Fabricated in moulded rubber sheeting and covered by a stainless steel anti-corrosion sheath, the mats are provided with eight metal elements which are heated successively by means of an electric current controlled by a cyclic switch mounted on the rotor hub.

Icing conditions will be simulated by stationing the helicopter at heights from 50 to about 70 ft. in a cloud of steam blown through the nozzles of an especially designed low temperature spray rig, installed at the top of a tall mast. As the steam condenses on the rotor blades it becomes frozen and an ice film is gradually built up. Power for the operation of the de-icing equipment will be provided by a ground alternator connected to the Sycamore by a trailing lead. By this method it will be possible to assess the power rating needed to meet various icing conditions, and obtain the necessary data for the design of a special airborne alternator.

Three More Schools Added to Convair Plan

Fort Worth, Tex.—Convair has added three more schools to its list participating in its engineering co-op plan.

Under the project, students divide their time between formal and practical education in Convair's engineering department. The new schools are Northwestern University, Purdue University and Missouri School of Mines, to make a total of 15 participating.

TEAMWORK

TO HAUNT AGGRESSORS' DREAMS

These two great fighters incorporate HARTWELL *Flush Latches for aerodynamic streamlining and simple, fast accessibility.*

The HARTWELL Flush Latch has evolved in our modern aviation age as the ultimate culmination of positive-action, aerodynamically flush latches.

The Cowling heavy duty flush latches for power packs and nacelle lock in place by toggle mechanism and applied load holds them closed; simple tee-bolt and trigger opening action; they fit a wide range of structural curvatures.

The Access trigger-action flush latches are available in over 300 standard combinations of bolt and trigger offsets for access panel and door applications; they afford quick access, safety and dependability.

Manufacturers of Aircraft Flush Latches and Hinges, Fittings and Cable Terminals.

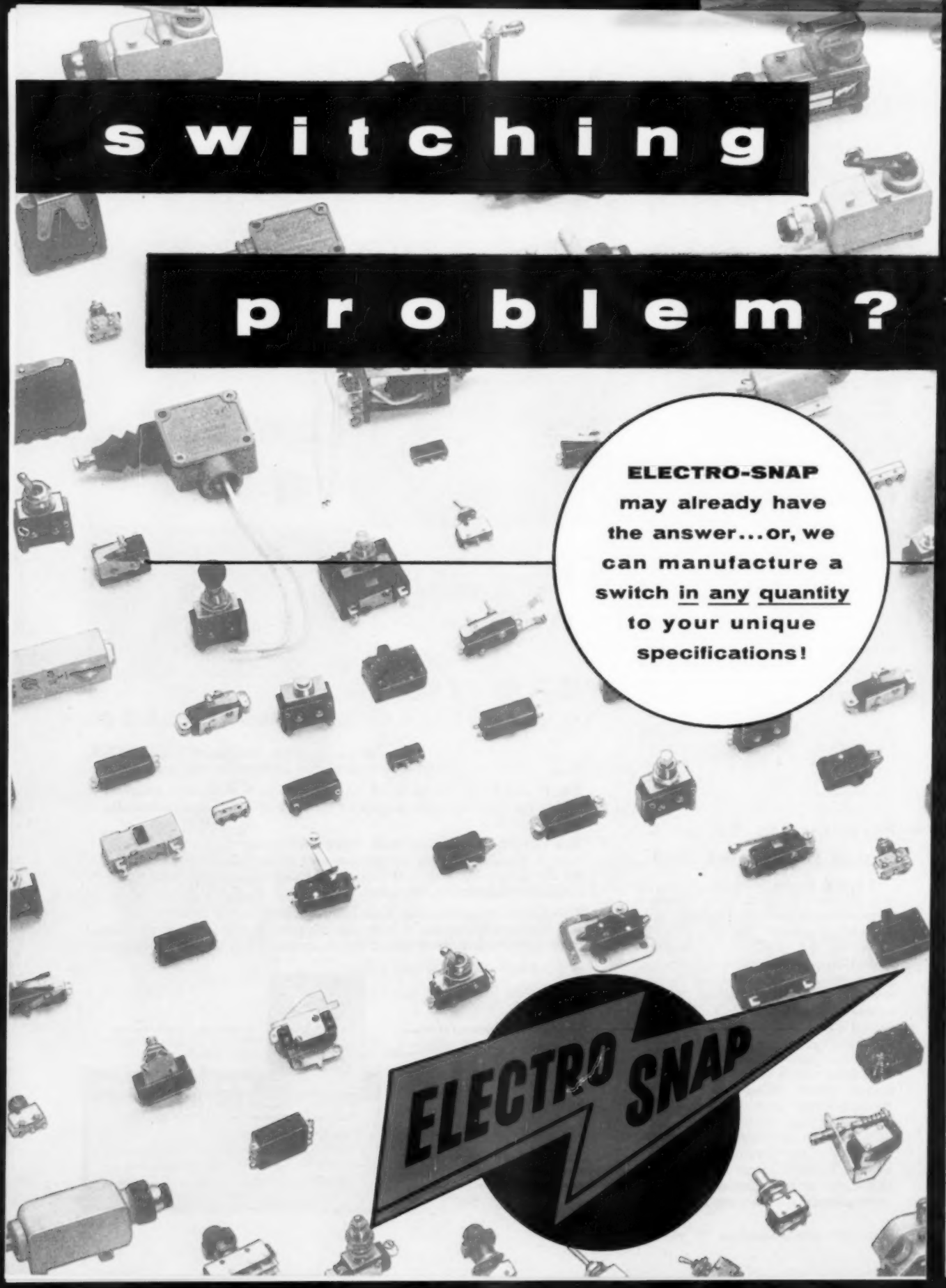
New 72 page, 2-color Catalog illustrates and gives full details of complete line.

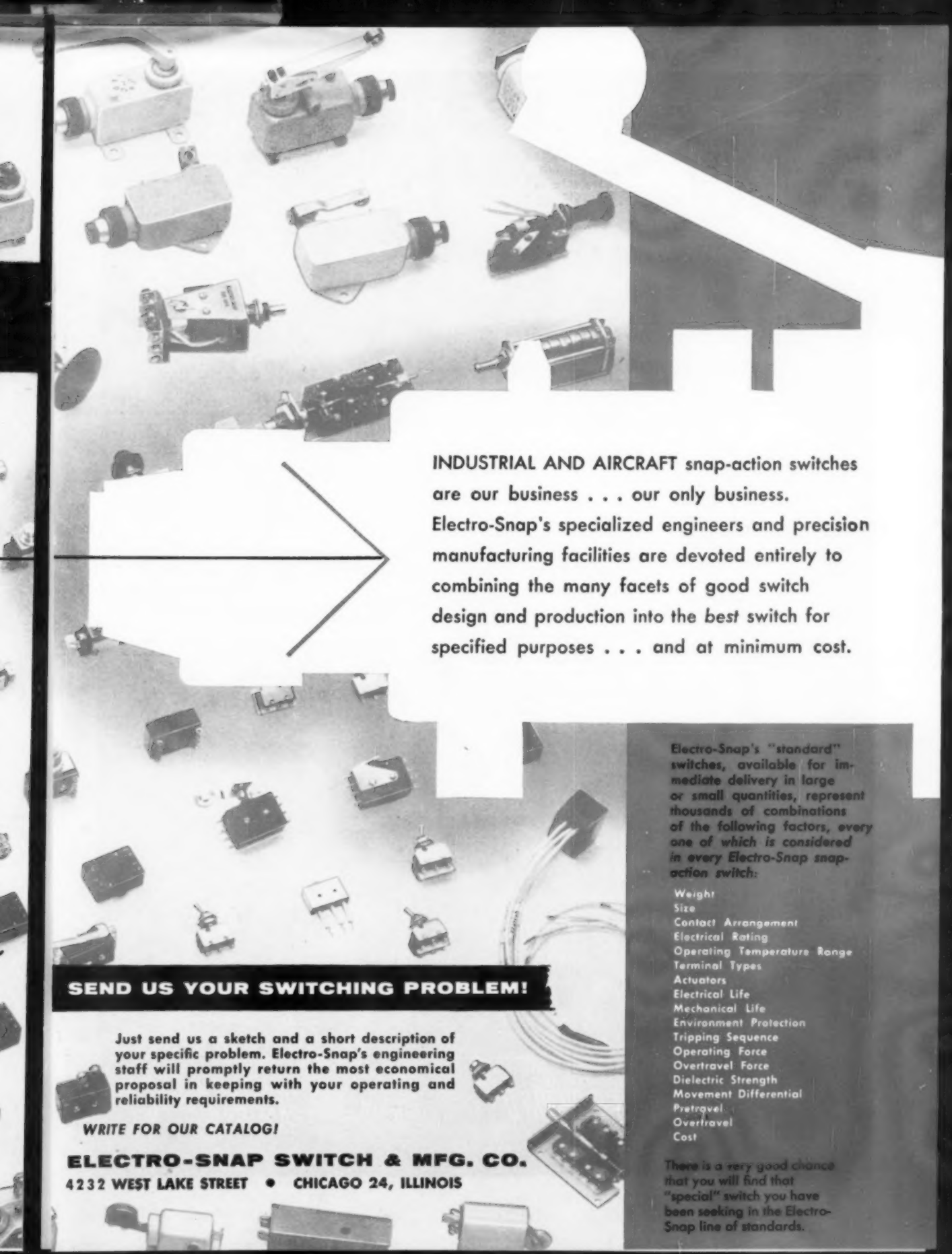
"Flush Latch Design Specialists"

HARTWELL AVIATION SUPPLY CO.
9035 Venice Boulevard
Los Angeles 34, California
Branch Offices: Wichita, Kans.; Fort Worth, Texas

MAIL COUPON

HARTWELL AVIATION SUPPLY COMPANY
9035 Venice Boulevard, Los Angeles 34, California
Send illustrated Catalog
NAME_____
COMPANY_____
ADDRESS_____
CITY_____ ZONE_____ STATE_____ AW


switching
problem?
ELECTRO-SNAP
may already have
the answer...or, we
can manufacture a
switch in any quantity
to your unique
specifications!
ELECTRO SNAP



INDUSTRIAL AND AIRCRAFT snap-action switches are our business . . . our only business. Electro-Snap's specialized engineers and precision manufacturing facilities are devoted entirely to combining the many facets of good switch design and production into the *best* switch for specified purposes . . . and at minimum cost.

SEND US YOUR SWITCHING PROBLEM!

Just send us a sketch and a short description of your specific problem. Electro-Snap's engineering staff will promptly return the most economical proposal in keeping with your operating and reliability requirements.

WRITE FOR OUR CATALOG!

ELECTRO-SNAP SWITCH & MFG. CO.

4232 WEST LAKE STREET • CHICAGO 24, ILLINOIS

Electro-Snap's "standard" switches, available for immediate delivery in large or small quantities, represent thousands of combinations of the following factors, *every one of which is considered in every Electro-Snap snap-action switch:*

Weight
Size
Contact Arrangement
Electrical Rating
Operating Temperature Range
Terminal Types
Actuators
Electrical Life
Mechanical Life
Environment Protection
Tripping Sequence
Operating Force
Overtravel Force
Dielectric Strength
Movement Differential
Pretravel
Overtravel
Cost

There is a very good chance that you will find that "special" switch you have been seeking in the Electro-Snap line of standards.

SPEED CONTROL

creates a supporting skyway to your desired touchdown point

Pilots can now pinpoint their runway touchdown spot with the aid of the SAFE FLIGHT Speed Control System. This system accurately provides a fixed lift ratio, insuring precision of control and preventing undershooting or overshooting of runways. Available for glare shield or panel mounting.

For aircraft in design stage, ask for complete installation proposals.

Owners of business or personal aircraft write for brochure SF-10.

SAFE FLIGHT INSTRUMENT CORPORATION
WHITE PLAINS, NEW YORK

"Pioneers in Lift Instrumentation"

Wing Tank Contains Missile Guidance

San Diego—Environmentally correct information on performance of a supersonic missile guidance package in flight test is being obtained by Ryan Aeronautical Co. engineers using a T-33 with one wing tip tank reworked to contain the guidance package and support equipment.

The T-33 makes flight test passes at an Air Force B-47 with the guidance package's performance record being sent back by FM/FM telemetering system during each pass to a mobile ground recording station.

An innovation in the tip tank test bed is utilization of nitrogen under high pressure as a power source for hydraulically operated components of the guidance package. The T-33 electrical system proved to be incapable of delivering enough electrical power to drive a sufficiently large hydraulic pump during test passes, so the charged nitrogen system was substituted.

Basic Tip Tank

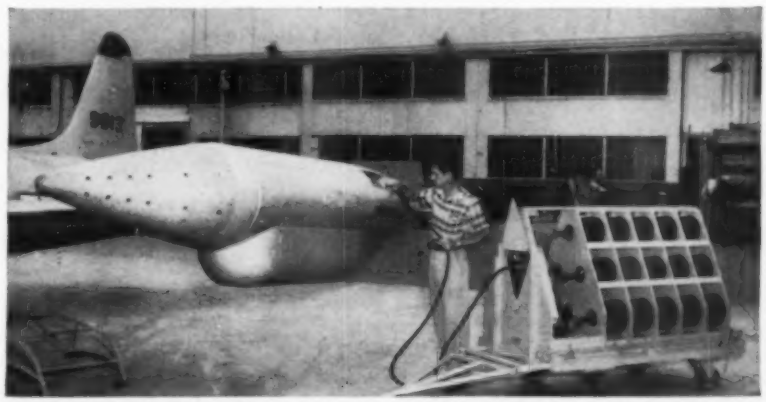
Ryan engineers took the basic T-33 tip tank, removed the nose, reworked it into a radome, and installed the necessary power supplies and junction box where all nose section electrical connections terminate. They then disassembled the tank's interior structure, took the guidance package hydraulics assembly apart and reassembled structure and guidance inside the tank in the manner of constructing a ship model in a bottle. The rear of the tank contains sensing switches, control valves and hydraulic system recycling pump. Also provided are external hydraulic power connections for system ground test.

Providing the substantial hydraulic force needed during each pass are four 2,000 psi. charged nitrogen bottles which drive three hydraulic accumulators during each pass. The high pressure nitrogen gas flows through a regulator and three-way solenoid valve to the nitrogen side of the accumulators, where it provides a steady push and power source during the test pass.

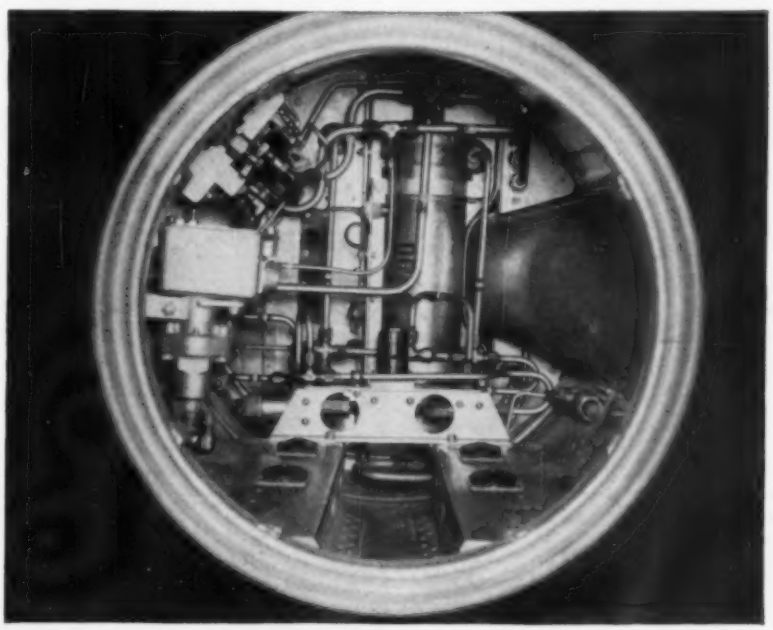
By the time the pass is completed, the hydraulic fluid is expended from the accumulators. The nitrogen then is dumped overboard and the hydraulic recycling pump refills the hydraulic side of the pistons from the hydraulic reservoir preparatory to the next pass. Recharging of the system is accomplished when the T-33 observer-operator pushes the recycling button, the only part of the hydraulic system with which he must be concerned in flight.

Pressing the recycling button not only recharges the hydraulic side of the piston accumulators, it also sequences in

RYAN PILOT and observer-operator monitor the guidance package performance in the air.



NITROGEN supply cart expedites refilling of the airborne system's four 2,000 psi. bottles.



STILL MORE equipment will be crammed into this area—the interior of the tip tank test bed center section.

the nitrogen pressure again to furnish power for the next pass.

Not all the guidance package is contained inside the tip tank. A pod beneath the main section of the tank contains the hydraulic reservoir, telemetering equipment and electronic components of the guidance package.

The rear seat panel in the T-33 was modified by Ryan engineers in such a way that the equipment in the tip tank can be changed completely, yet the hookup into the panel remains almost intact and only minor modifications need be made on the panel. Cables between tip tank and panel are run through the wing leading edge.

PRODUCTION BRIEFING

Pacific Airmotive says that it has received the first F-86 overhaul contract ever awarded a private maintenance company. The firm received $750,000 to recondition and modify F-86A, E and F Sabres under the Air Force's IRAN program.

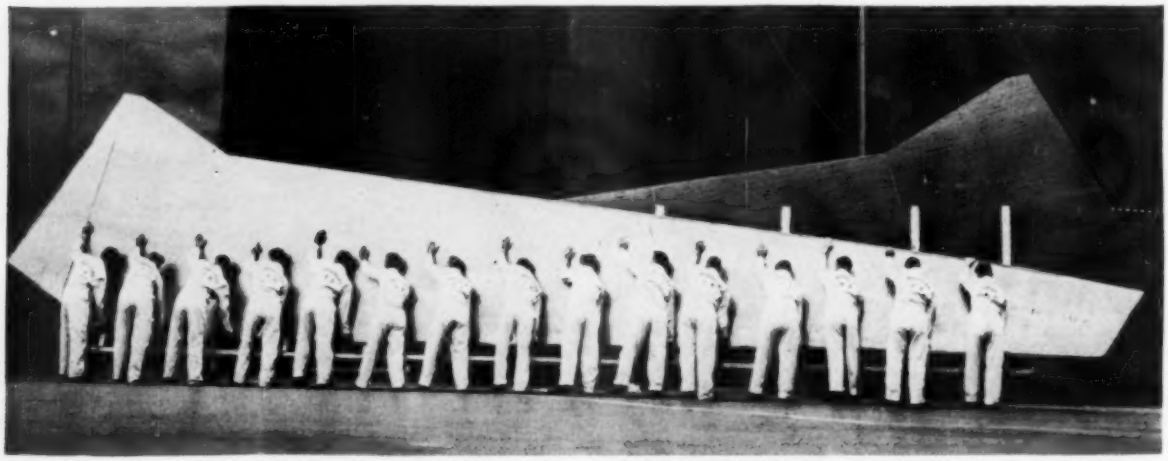
Stauffer Chemical Co., San Francisco, announced it plans to increase its boric acid plant here by 50% at a cost of $500,000. Boric acid is a raw material for ceramics and boron chemicals. A few months ago Stauffer announced it was enlarging its Niagara Falls boron trichloride plant ten-fold.

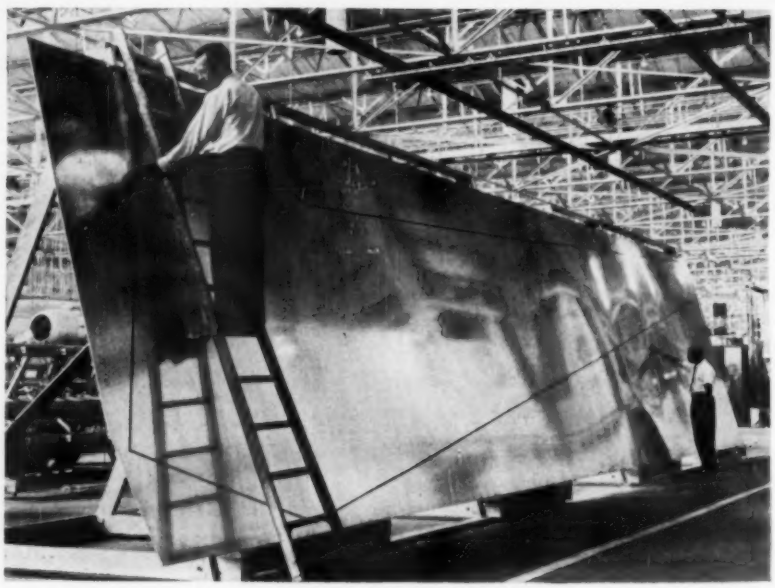
Parker Appliance Co., Cleveland, Ohio, makers of aircraft O-ring seals, reports a net profit of $335,706 on sales of $5,738,128 for the three months ending Sept. 30 as compared to a loss of $13,646 on sales of $4,645,884 for the corresponding three months of 1955.

The Aluminum Association, New York, reports 2,473,299,931 lb. of primary aluminum production produced in the U. S. this year through September. All-time record month was July of this year with 303,248,010 lb. being produced. End-use statistics show that civilian markets are taking as much aluminum as military.

H. & B. American Machine Co., Inc., Chicago, says sales rise from $9,176,668 last year to $10,201,071 this fiscal year (ending July 31, 1956) indicates potential for heavy machined components for the aircraft industry is up to expectations.

Douglas Aircraft Co., Santa Monica, Calif., is constructing $5 million in new facilities to house its DC-8 and missile programs. In this expansion is included a $1½ million test facility which has an acoustics laboratory, pneumatic systems laboratory, static test "torture chamber", control systems laboratory and an expansion of their electrical laboratory. In the $250,000 acoustics laboratory, the destructive effect of engine energy trans-

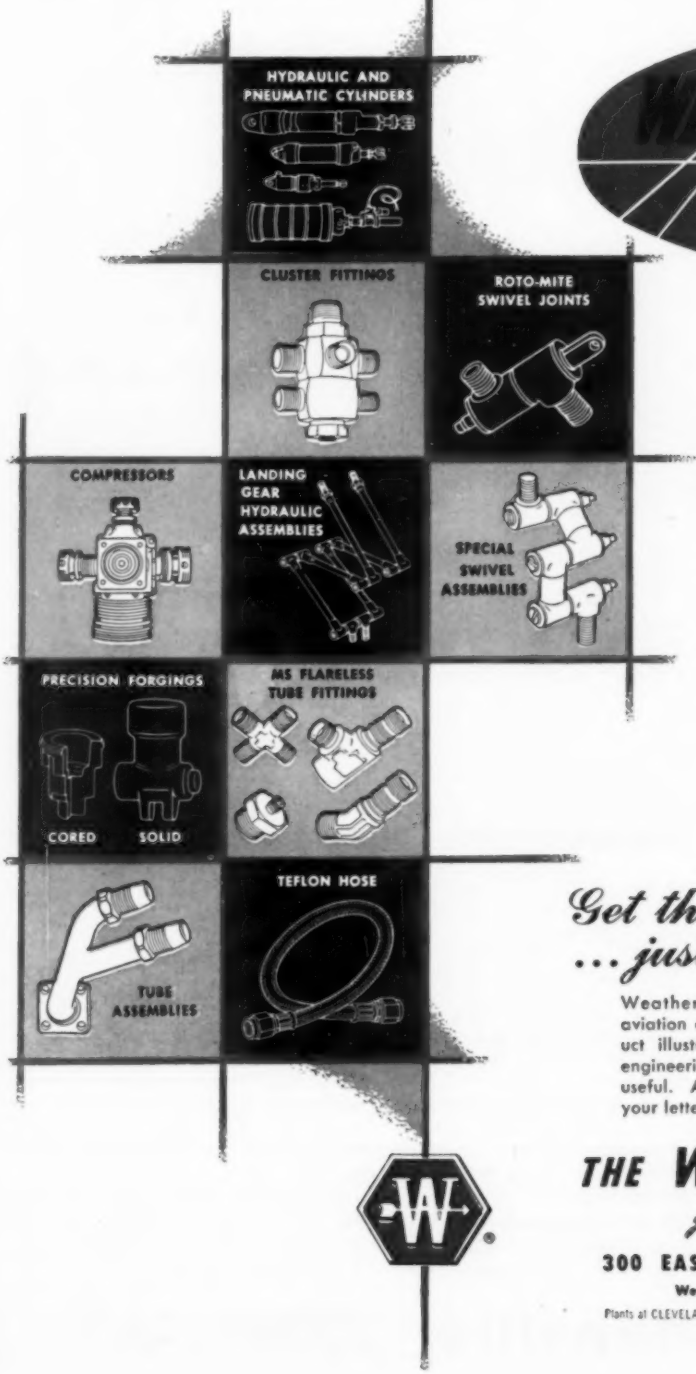




DC-8 Wings

Douglas DC-8 wings are being cut from large tapered sheets of aluminum. Manufactured at the world's largest aluminum mill, the Davenport, Iowa, plant of the Aluminum Co. of America, the huge sections are 10 ft. 4 in. wide by 45 ft. 10 in. long and .230 thick at the heavy end for a distance of 14 ft. 7 in. From this point the section tapers to a thickness of .129 in. at the light end. The pieces, used for the inner portion of the DC-8 wings, are being marked for cutting in photos.

FORERUNNERS OF TOMORROW... *these Products of Precision by*

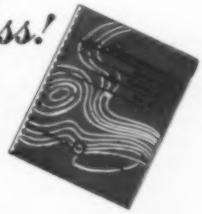


WEATHERHEAD
AVIATION DIVISION

Here you see just a few of the hundreds of complicated precision components and assemblies being supplied to the aviation industry by Weatherhead. Ability to tackle and solve complex problems is evidenced in the nature and range of products like these.

Important as they are in today's scheme of things, these are but the forerunners of finer things to come. For here a policy of aggressive research is coupled with practical design engineering in the constant search for solutions to problems of the future. Weatherhead's fund of knowledge, skill and experience can be of service to you. Your precision product requirements will be reviewed in confidence and without obligation.

Get this catalog... ...just off the press!



Weatherhead's new comprehensive aviation catalog is packed with product illustrations, technical data and engineering notes that you will find useful. Ask for Catalog AC-301 on your letterhead.

THE WEATHERHEAD COMPANY
Aviation Division

300 EAST 131st STREET • CLEVELAND, OHIO

West Coast: 1736 STANDARD AVE., GLENDALE, CALIF.

Plants at CLEVELAND and ANTWERP, OHIO • GLENDALE, CALIF. • ST. THOMAS, ONTARIO, CANADA

HEAT that could buckle an aircraft's skin
The engine compartment of McDonnell Aircraft Corporation's F-101A *Voodoo* is protected with J-M structural insulation. This new long-range fighter was recently ordered into quantity production by the Air Force.

. . . safely controlled by new Johns-Manville structural insulation

New Problems. The engine compartment of today's jet aircraft is a "hot spot" both literally and figuratively. Not only are engine temperatures rising higher; greater speeds have produced higher air flow velocities and complex pressure problems. These new conditions call for a radical departure in insulation design.

New Answers. Many designers have successfully combatted these engine compartment heat problems with the help of Johns-Manville. In the J-M laboratories new insulating methods have been developed which are adaptable to practically every type of aircraft. Among these is a totally new concept in structural insulation designed especially for engine compartments in the new Century series as well as the latest naval aircraft.

Matchless Experience. In the field of jet aircraft insulation, no other company can match the experience of Johns-Manville insulation scientists. From the very beginning of the jet age they have been working closely with all the major engine and airframe manufacturers. Today they are busy developing new materials in new shapes and sizes for the insulating problems of tomorrow.

Why not put this experience to work for you. Write Johns-Manville, Box 14, New York 16, N. Y. In Canada, Port Credit, Ontario.

JOHNS-MANVILLE JM PRODUCTS **Johns-Manville** PRODUCTS FOR THE AVIATION INDUSTRY

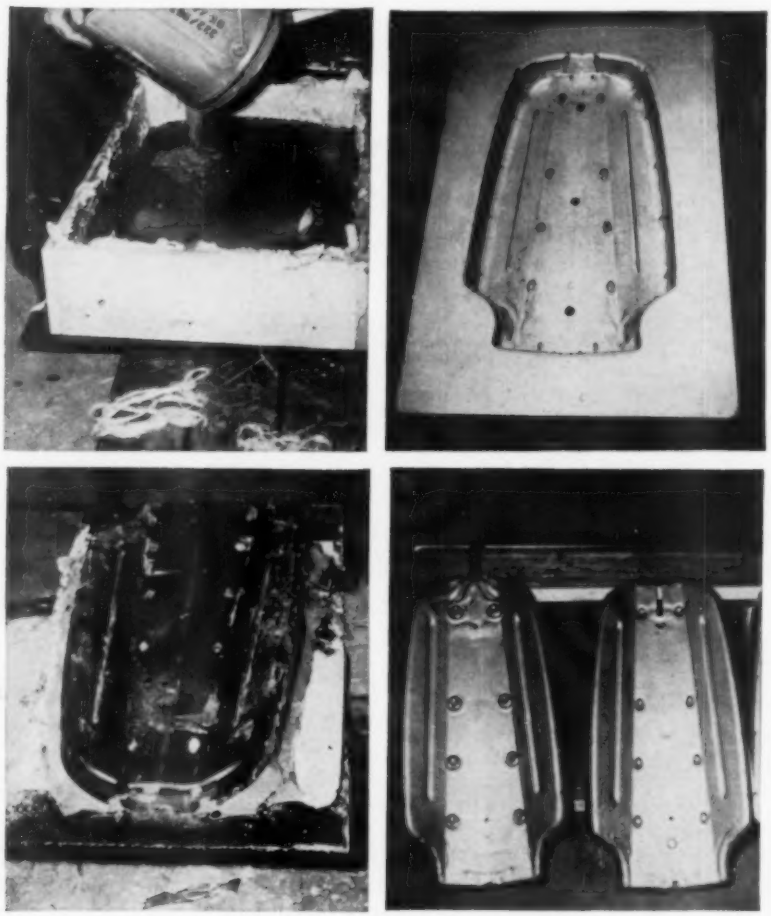
mitted by sound, aircraft passengers, structure and equipment, will be studied.

Kaiser Aluminum & Chemical Corp., Oakland, Calif. is acquiring the Hokin Aluminum Co. extrusion plant at Dolton, Ill. The new plant will have an annual output capacity of 18,000,000 lbs. of extruded shapes.

NACA's $5 million reactor facility at Sandusky, Ohio, is being constructed under the direction of James R. Braig and M. V. Organ, both of the NACA Lewis Laboratory at Cleveland. Contracts have been let to the Kilroy Structural Steel Co., Cleveland and to the Hammond Iron Works, Warren, Pa., for the reactor building and the containment tank.

Allegheny Ludlum Steel Corp., Pittsburgh, Pa., has completed a furnace which can produce a 2,200 lb. ingot of high-purity zirconium at a monthly rate of 50,000 lbs. per month. Zirconium is urgently needed for structural and fuel element applications in atomic reactors.

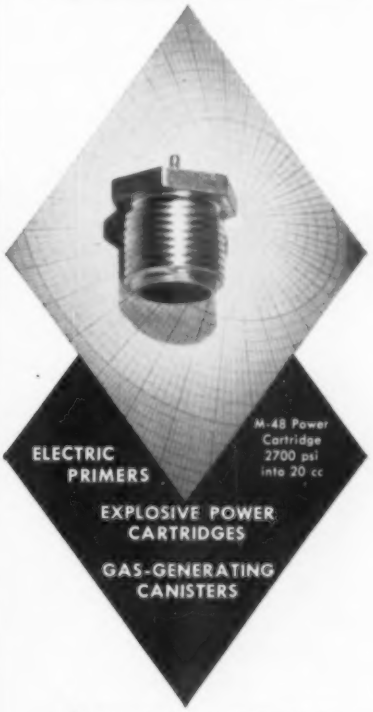
Lubrication pump is design for attachment to the bottom of a vertical shaft which it lubricates. This simple pump



Short Run Tooling for Metal Stamping

Female die (left, above). A wooden pattern has been placed in this box and several layers of glass cloth, which can be seen sticking up over the edges of the box, have been laid over the pattern and brushed up with Rezolin L-900 epoxy plastic to form die surface. A workman is backing up the laminate by pouring in a mixture of epoxy and buckshot. Finished female die (right) removed from the box with the pattern pulled out. Male die and finished stamping (left, bottom). Rezolin L-940 flexible epoxy makes resilient punch to mate with female die. The male die was cast inside a plaster mold made from the same wooden pattern that was used for the female die. One hundred stampings of this metal part (right) were made in these plastic dies by the Great Lakes Division of Rockwell Spring and Axle Co., Chicago, Ill. The tooling plastic was from Rezolin, Inc., Los Angeles 45, Calif.

SQUIB SPECIALISTS



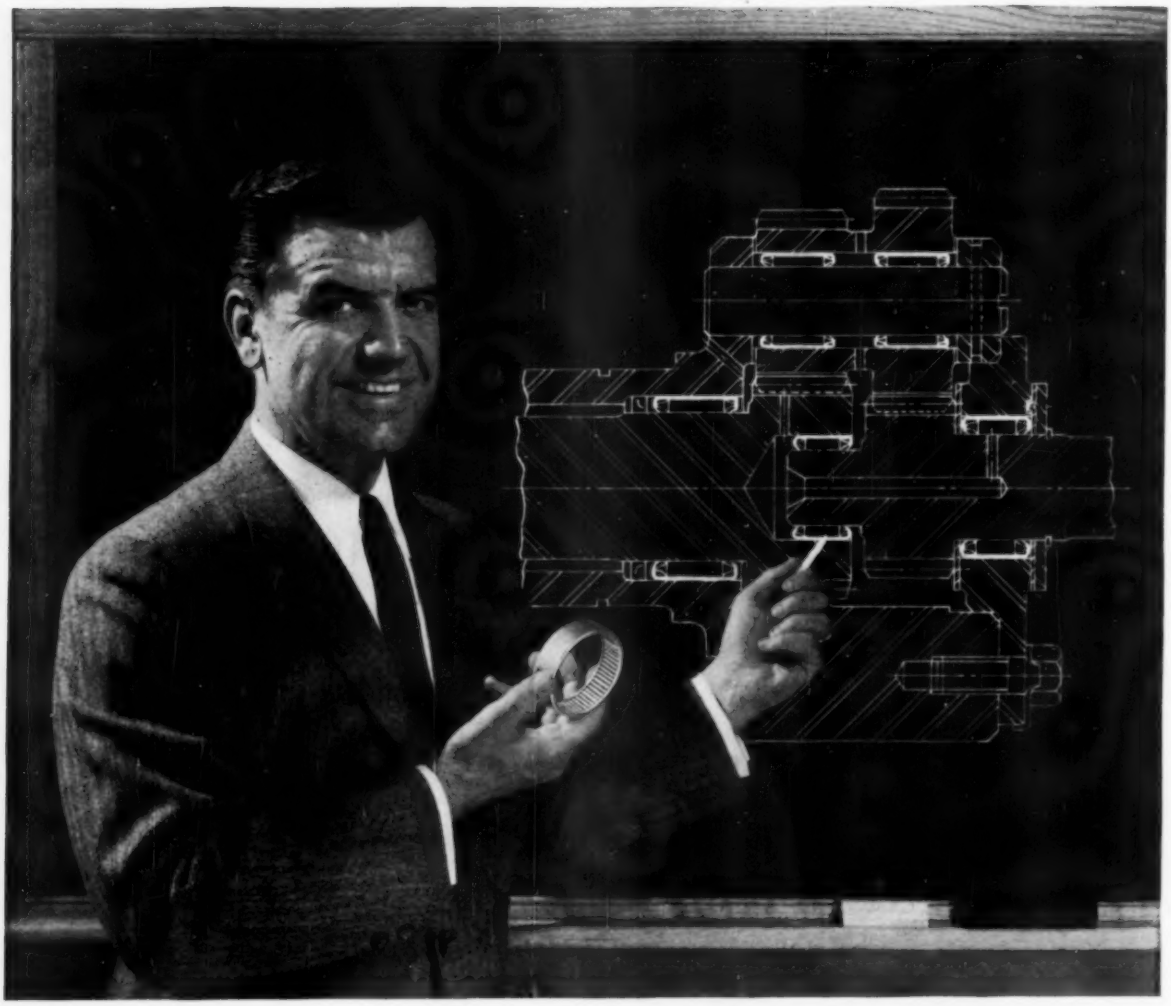
An organization specializing in the design, development, and manufacture of explosive ordnance, McCormick Selph places first emphasis on dependability. The entire group is located in a 60,000-sq-ft plant on a 200-acre site having perhaps the most complete facilities of its kind in existence.

Your procurement and reliability problems in specialized explosives* can probably be solved at McCormick Selph — either with standard items, tried and proved, or with units produced to meet your specific need.

Send for data or submit your problems to:

* *Ignition*
Actuation
Ejection
Fracturing

McCORMICK SELPH ASSOCIATES
HOLLISTER 1, CALIFORNIA



"It's a perfect spot for a **TORRINGTON NEEDLE BEARING!"**

No one can spot a potential needle bearing application as well as a Torrington engineer.

He will summon the unmatched experience of our Engineering Department to give your product the unique advantages of the Torrington Needle Bearing. And he will draw on our extensive file of previous applications for clues that may help solve your specific anti-friction bearing problems. You can rely on him, too, to review all engineering details so that the application will go into production smoothly and perform satisfactorily in service.

If high radial load capacity, limited space or unit cost enter into your choice of a bearing, chances are you should consider a Torrington Needle Bearing. We may be able to add your product to the thousands which have enjoyed the benefits of this unique bearing.

See our New Needle Bearing Catalog in Sweet's Product Design File—or write direct for a catalog.

TORRINGTON NEEDLE BEARINGS
Give you these benefits

- low coefficient of starting and running friction
- full complement of rollers
- unequalled radial load capacity
- low unit cost
- long service life
- compactness and light weight
- runs directly on hardened shafts
- permits use of larger and stiffer shafts

THE TORRINGTON COMPANY
Torrington, Conn. • South Bend 21, Ind.
District Offices and Distributors in Principal Cities of United States and Canada

TORRINGTON BEARINGS

Needle • Spherical Roller • Tapered Roller • Cylindrical Roller • Ball • Needle Rollers

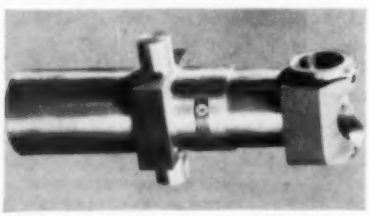
operates by the oscillation of the horizontal piston as its ends ride against an eccentric race. Check valves above and below the piston direct the oil flow which is delivered out the top of the pump into the hollow main shaft above and thence to the main shaft's bear-

ings. This 3-in. version was designed to operate at speeds from 20-400 rpm. An especial advantage of this design is that it can provide built-in lubrication for hard to reach places, according to the makers, Bijur Lubricating Corp., Rochelle Park, N. J.

Heat chambers for observing jet engine metals under various loadings at General Electric's Thomson Labora-

tory, Lynn, Mass. Present 1,650F upper limit will be increased to 2,000F.

Taylor Model 28112-16 shock absorber is designed to absorb 22,500 in. lbs. of energy at 360 in. per second velocity in industrial applications. It handles a 10,000 lb. mass and has built-in damping. The Liquid Spring Shok is



(Advertisement)

Valve Talk

FOR WM. R. WHITTAKER CO., LTD.

BY MARVIN MILES

Henry (Hank) Waller, head of Whittaker's fuel system section, has an A for a middle initial, but he's quite cagey about what it stands for.

Just between you and me, it's Adam!

Hank, a transplanted Long Islander who now gets his exercise by pushing a lawn mower, started on his road to an engineering degree at PS 73 in Queens and bustled through Grover Cleveland High School and the Polytechnic Institute of Brooklyn (B.M.E.) before he was 21.

Today, tall, blue-eyed, somewhat balding, he's an energetic and outspoken 33, foreseeing in Whittaker a wealth of opportunity.

Graduating from Polytechnic (after working for Pratt & Whitney as an experimental test engineer during summer vacation), Hank went to work for Aircooled Motors in Syracuse late in World War II and shortly found Uncle Sam giving him come-hither looks.

With a penchant for the Navy, he found himself in the middle, so to speak, for although he had a mechanical engineering degree he was considered too young for an engineering commission and too old (at 20?) for flight training.

Hank Waller, Project Engineer, Fuel Systems Group

Instead, he was drafted as an apprentice seaman. But in a matter of days, after taking a technical test, he was upgraded to seaman first class and hustled through three Navy technical schools to emerge as an electronics technician third class.

After a brief tour of sea duty – he was shipped to Japan and assigned to a destroyer that was shortly ordered home. Hank was discharged with an excellent electrical training which he now uses to repair his television set!

He joined Republic Aviation in March 1946 as a power plant analyst, worked his way up to principal thermodynamicist in charge of fuel system analysis and eventually to power plant staff engineer for fuel systems.

In all, he worked for Republic nine years and nine months, assigned to a variety of projects that included the Rainbow transport, the F-84 Thunder series from C to H, the F-103 interceptor and the F-105 fighter-bomber.

Late last year came the opportunity to join Whittaker. Hank talked it over with his wife, Loretta, and they decided the new position would be worth uprooting the family – including two children, Paul, 10, and Susan, 8 – and crossing the continent to Southern California.

Reporting to work in January, he was assigned first to Del Phillips' research department where he stayed for three months, absorbing the Whittaker operation before taking over as project engineer for fuel systems, with some sixteen engineers under his immediate supervision.

With so much going on in his section – a dozen new developments reaching the completion stage, a dozen older units to follow up, and an equal number of new proposals to consider – Hank has found little time to enjoy his private pilot's license (150 hours).

His recreation, other than muscling his lawn mower, has been sightseeing in Southern California, driving what he calls his "beat-up" XK-120 Jaguar, and watching his outboard motor boat gather dust in the garage while wondering how he can find time and opportunity to use it.

For Hank's not only busy at Whittaker; he's an active member of the S.A.E.'s fuel systems committee and the Coordinating Research Council's fuel research group.

At Whittaker, Hank's section is responsible for the engineering on all fuel system components, valves ranging from one-quarter inch to four inches, pumps handling from five to two hundred gallons per minute, AC, DC or hydraulically powered tiny shut-off valves, large, complicated components, flow dividers, high-pressure cartridge-type units – a wide and expanding field.

His immediate concern is common to the entire industry, the rugged step-up in specifications; higher and higher temperatures, greater pressures, faster flows, ever more-exact controls, together with lighter, more compact units.

"Specs are becoming more exacting, more limiting, more detailed all the time," Hank says, "and proposal costs are successively greater." But he feels the end results are better. And that's what counts.

"Now, here, you see, it takes
all the running you can do,
to keep in the same place."

Charles Lutwidge Dodgson and the Red Queen

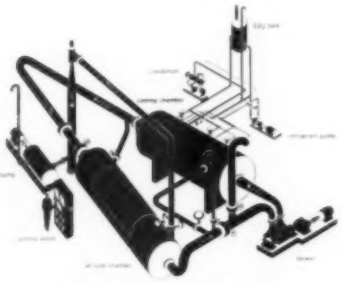
Dr. Dodgson would be delighted with a parallel to the prophetic environment he devised for his Red Queen and Alice in his classic "Through The Looking Glass." The advanced-electronics industry is running as fast as possible to keep ahead of Tomorrow. But certain of America's advanced-electronics companies have achieved in their work a velocity that has borne them beyond hitherto unexplored frontiers. Litton Industries is among them.

LITTON INDUSTRIES BEVERLY HILLS, CALIFORNIA
Plants and Laboratories in California, Maryland, Indiana and New York

DIGITAL COMPUTERS & CONTROLS · RADAR & COUNTERMEASURES · INERTIAL GUIDANCE · SPACE SIMULATION RESEARCH
MICROWAVE POWER TUBES · AUTOMATIC DATA PROCESSING · SERVOMECHANISMS · PRECISION COMPONENTS & TRANSFORMERS

made by Taylor Devices, Inc., North Tonawanda, N. Y.

Janitrol's high altitude test system will maintain 20 ft. long by 6 ft. dia. test chamber at 80,000 ft. simulated altitude. It will be able to maintain −65F even though testing combustion equipment putting out a million BTU per hour of heat. The blower circulates air at 4,000 cfm. through the cooling chamber which operates in five stages



Janitrol high altitude testing system

of mixed mechanical refrigeration and liquid CO_2 sublimation. Vacuum pumps each pull 1,500 cfm. from the test chamber. The Columbus, Ohio firm will use the facility to speed up the development of their aircraft heating equipment, heat exchangers, pneumatic control equipment and couplings for high pressure duct-work.

An 18 psi vacuum holds part of the Martin TM-61 Matador nose skin to the matching glass-plastic laminate while the missile part is being trimmed. The sides and ends of the plastic backing fixture are properly beveled to guide the part past the saw blade as the workmen slide the fixture on the table. The

vacuum is applied through a network of grooves on the surface of the fixture with a ¼ in. rubber tubing seal around the inside edge of the skin. The vacuum is created by a Marvac venturi. This fixture has eliminated the hand cutting and filing operations formerly required, according to the Martin Co., Baltimore, Md.

NOW AVAILABLE
TO ENGINEERS & SCIENTISTS

The Papers Presented
at the Guided Missiles Technical Forums

HELD BY THE
MISSILE & ORDNANCE SYSTEMS DEPARTMENT
OF GENERAL ELECTRIC

The Technical Forums held by authorities from the Missile & Ordnance Systems Department (then called the Special Defense Projects Department), of General Electric in New York City and Buffalo last Spring were unusually well received, attracting large audiences of engineers and scientists interested in keeping up with the very latest developments in the field of Guided Missiles.

In view of the intense interest in these forums, and the subsequent requests for reprints of the papers presented, we have decided to make them available upon request.

Papers presented were on the following subjects:

SOME AEROPHYSICS PROBLEMS CONNECTED WITH HYPERSONIC FLIGHT
by Dr. John W. Bond, Jr. — *Aerophysicist*

PROBLEMS OF SYSTEMS ENGINEERING
by Mr. A. W. Robinson — *Manager, Systems Engineering*

EXPERIMENTS IN HYPERSONICS
by Dr. Yusuf A. Yoler — *Hypersonic Scientist*

THE INTEGRATION OF SYSTEMS TEST
by Mr. William R. Eaton — *Manager, Quality Control and Test Engineering*

MISSILE AEROPHYSICS
by Dr. Joseph Farber — *Manager, Aerophysics*

STRUCTURAL FRONTIERS
by Mr. Samuel Levy — *Manager, Stress Analysis Engineering*

To receive your set of these papers, collected in a convenient folder, please write:
TECHNICAL FORUM, ROOM 508-3
MISSILE AND ORDNANCE SYSTEMS DEPARTMENT
GENERAL ELECTRIC
3198 Chestnut Street, Philadelphia 4, Pa.

WORLD'S FASTEST FIGHTER LANDS ON

COMPACT CPT LIQUID SPRING

Hardest-working component of the Lockheed F-104 landing gear is its compact liquid spring, engineered and built by Cleveland Pneumatic.

CPT Liquid Springs provide high load absorption within the minimum space available on this razor-wing aircraft. Over 70,000 test cycles proved the reliability of the liquid spring principle.

Whether your aircraft designs permit use of conventional AEROL* shock-absorbing struts or whether razor-thin wings create space problems, CPT will design and build landing gear to handle the job dependably. We've been solving landing-gear problems for over 30 years. Our modern 350,000-square-foot plant is equipped to produce CPT AEROLS or Liquid Springs to fit your production schedule.

*T.M.

BE A CPT ENGINEER!

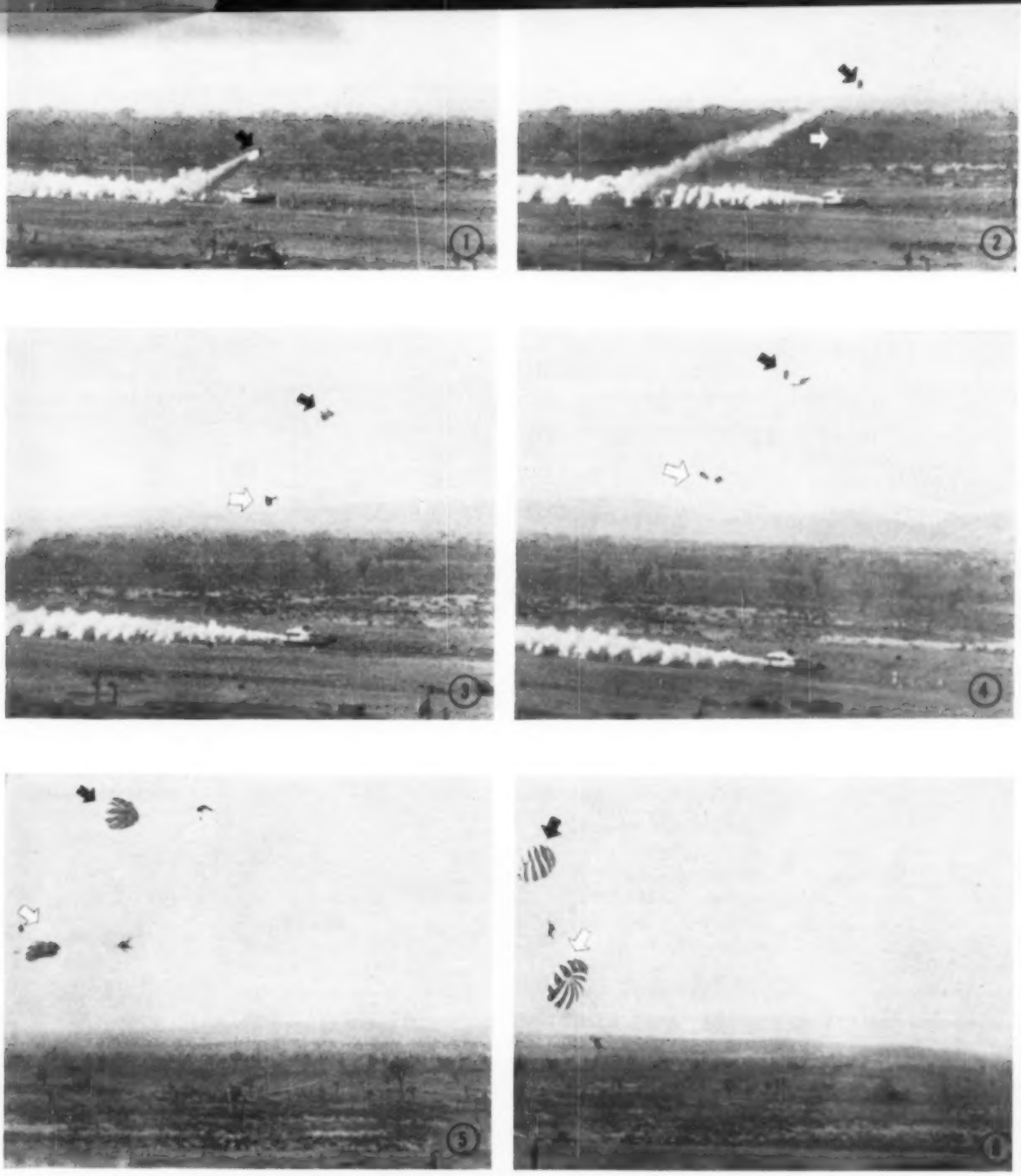
Liberal pension and profit-sharing plans, interesting work, plenty of advancement opportunity. Tell us your qualifications today.

CPT

CLEVELAND PNEUMATIC TOOL COMPANY

3781 East 77th Street • Cleveland 5, Ohio

Sales-engineering offices in Seattle, Los Angeles, Fort Worth-Dallas and Levittown, L.I.



New Pilot Ejection System

Convair compares its new rocket-tube ejection system slated for the F-106 against the standard AF M3 telescoping tube ejection catapult using the Edwards AFB high speed sled. For one of the first tests (AW Nov. 12, p. 71), two dummies were shot out of a side-by-side cockpit TF-102A mock-up. Shortly after the first dummy was ejected by Talco Engineering Co.'s combined rocket-tube catapult, the remaining dummy was fired from the cockpit by a standard M3 telescopic tube ejector. These pictures verify that the rocket-tube fired dummy went up higher and parachuted down easier than the conventional tube fired dummy. Picture shows first dummy being rocketed from the cockpit with its rocket exhaust streaming behind. Note that at the subsonic speed at which this test was being made the forward component of the canted rocket is accelerating the dummy ahead of the sled. The rocket is canted to lessen the pilot deceleration due to slipstream at higher speed ejects. Next picture shows rocket has burned out on first dummy and second dummy's M3 has just catapulted it from the cockpit. Rocketed dummy is just being separated from his seat, Picture No. 3. No. 4 shows both dummies being separated from their seats. No. 5 shows their parachutes opening and No. 6 shows how even though the rocket-tube fired dummy was ejected first it takes longer to land providing a greater margin of safety for the pilot in sea-level ejections. At 240 mph. sled speed the rocket boosted seat went up 124 ft. compared to 55 ft. for the M3 seat.

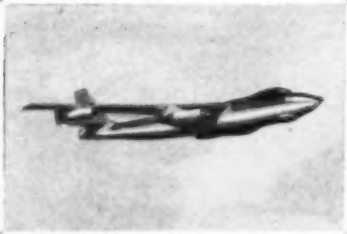
***Lockheed Electra**—equipped with a Honeywell Transistorized Fuel Gage.*

***Martin YP6M-1 SeaMaster** equipped with a Honeywell Transistorized Fuel Gage.*

***Grumman F9F-8 Cougar** equipped with a Honeywell Transistorized Fuel Gage.*

***Cessna T-37A**—equipped with a Honeywell Vacuum Tube Gage.*

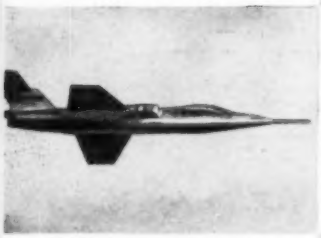
***Fairchild C-119**—equipped with a Honeywell Vacuum Tube Gage.*



***Boeing B-47**—equipped with a Honeywell Vacuum Tube Fuel Gage.*

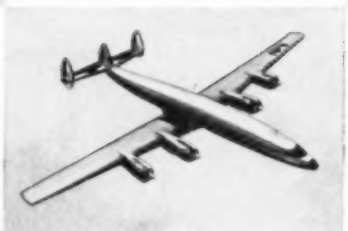
***Douglas DC-7C**—equipped with a Honeywell Transistorized Gage.*

***Vertol H-21**—equipped with a Honeywell Transistorized Fuel Gage.*



***Lockheed F-104A Starfighter** equipped with a Honeywell Transistorized Fuel Gage.*

***Cessna 620**—equipped with a Honeywell Transistorized Fuel Gage.*



***Lockheed 1649A Super Constellation**—equipped with a Honeywell Transistorized Fuel Gage.*

***Lockheed C-130A Hercules** equipped with a Honeywell Vacuum Tube Fuel Gage.*

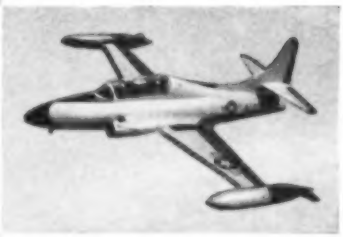
***Douglas DC-6B**—equipped with a Honeywell Vacuum Tube Gage.*

***Convair XFY-1 Pogo**—equipped with a Honeywell Vacuum Tube Gage.*

***Convair 440 Metropolitan** equipped with a Honeywell Vacuum Tube Gage.*

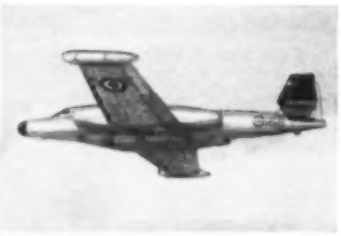
***Convair 340**—equipped with a Honeywell Vacuum Tube Gage.*

***Lockheed 1049G Super Constellation**—equipped with a Honeywell Vacuum Tube Gage.*



***Lockheed T2V-1 SeaStar** equipped with a Honeywell Transistorized Fuel Gage.*

***Martin P5M Marlin**—equipped with a Honeywell Transistorized Gage.*



***Avro CF-100 Canuck**—equipped with a Honeywell Vacuum Tube Gage.*

***Grumman FHF-1 Tiger** equipped with a Honeywell Transistorized Fuel Gage.*

***Boeing 377 Stratocruiser** equipped with a Honeywell Vacuum Tube Gage.*

***Boeing 707 Jet Stratoliner** equipped with a Honeywell Transistorized Fuel Gage.*

***Sikorsky S-56 Helicopter** equipped with a Honeywell Transistorized Fuel Gage.*

Today's standard of measurement—

ELECTRONIC FUEL GAGE BY HONEYWELL

Today, on practically every major aircraft—both commercial and military—you'll find a Honeywell Fuel Gage.

Lightweight, compact and ruggedly built, Honeywell Gages are adaptable to every type of installation and flight characteristic.

The universal preference for Honeywell Gages to perform the vital function of fuel measurement is based upon a number of excellent reasons—of which unquestionably, *reliability* and *accuracy* are foremost.

Honeywell assures reliability through the highest standards of quality control, plus endless operational testing.

And whether it's a Honeywell transistorized fuel gage, or a Honeywell vacuum tube gage, it has pin-point accuracy that can measure any fuel load to within two percent—even under the most severe operating conditions.

In addition to the many aircraft shown here, other representative aircraft that fly with Honeywell Transistorized Fuel Gages are: Martin RB-57D Canberra, Avro CF-105, Ryan Model R-69, Convair B-58, Boeing KC-135, Bell H-40.

For further information about Honeywell Gages and other automatic fuel system controls, write Honeywell, Dept. AW-11-215A, 2604 Ridgway Road, Minneapolis 13, Minnesota.

MINNEAPOLIS **Honeywell**

AERONAUTICAL DIVISION

MORE THAN MUSCLE

The airplane changes radically, and product requirements with it, but man remains much the same. Today it requires more than muscle to bridge this ever-widening gap between "Century-Series" aircraft and unchanging man.

At G. M. Giannini & Co., Inc. over 30 different types of engineers are combining technological skill with scientific knowledge to help bridge this gap.

Let this experience work for you by calling in your Giannini field engineer. You will gain from his ability and from the Company's decade of experience in solving instrumentation problems for major airframe manufacturers.

When accurate, reliable instruments and controls are *demanded*, specify Giannini precision-crafted products . . . products which are created with more than muscle.

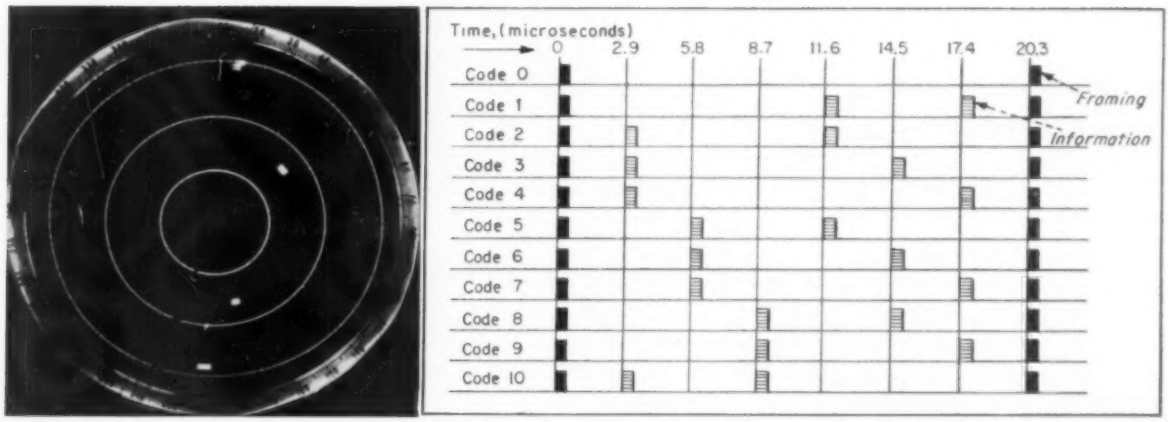
Giannini-equipped North American F-100C undergoing visual check prior to take-off.

Giannini

INSTRUMENTS · CONTROLS

Engineering positions are open at several Giannini locations for career-minded young men—write for details.

G. M. GIANNINI & COMPANY, INC. • 918 EAST GREEN STREET • PASADENA, CALIF.



NUMBER of transponder reply codes could be increased by using additional combinations of information pulse spacings or by using pulse pairs spaced at 1.45 microsecond intervals. Presently assigned ATC transponder codes are shown (right).

More Codes Crucial to ATC Beacon Use

By Philip J. Klass

Baltimore—ATC radar beacon system could prove to be the greatest boon to air traffic control since the advent of radar—providing the number of transponder codes now authorized by the Defense Department for Common System use can be increased by a factor of 10 or more.

This conclusion is based on a report by T. K. Vickers, air traffic control specialist at the Civil Aeronautics Administration's Technical Development Center in Indianapolis, presented here during the recent East Coast Conference on Aeronautical and Navigational Electronics. Vickers' report was based on TDC's two years of study, dynamic simulation and flight testing.

Beacon Advantages

If sufficient codes are made available, the ATC beacon system can provide air traffic controllers with:

- **Positive identification** of individual aircraft without need for ground-air communications or for special aircraft maneuvers. TDC simulation tests indicate that this type of code assignment is the most useful, Vickers said.
- **Barometric altitude** information for each airplane, giving controller much needed third dimension data without ground-air communications and attendant delays.
- **Filtering** which enables controller to display instantly on radar scope only those aircraft at any selected altitude, permitting instantaneous conflict check.

Although identity or altitude coding by itself is a valuable tool, the use of both in combination with existing primary radar information will greatly magnify the usefulness of the beacon system.

For example, if a traffic controller knows the identification code of any particular flight, he can instantly obtain its altitude and pinpoint which blip on the radar scope corresponds to that aircraft.

Of if the controller sees an unidentified target on his radar scope, he can instantly obtain its altitude and identity. Of if he seeks to check the traffic situation at some specific altitude, he can display the positions and identities of all aircraft at that altitude.

This cross-indexing feature means that if a controller has any one of these three vital bits of data (position, altitude or identity), he can obtain the other instantly. This, Vickers said, "should lead to a much needed simplification of traffic control procedures and a consequent reduction in controller workload."

Cross Indexing

This cross-indexing capability is particularly valuable because of the problem of combining all data needed by a traffic controller in a single display when primary radar is used. The traffic controller needs data on the identity of each aircraft, its type, speed, route, destination, assigned altitude and clearance limit.

If all of this data is displayed on small markers on the radar scope, it occupies a sizable optrion of the display area, Vickers pointed out. The problem is further complicated by the fact that a two-dimensional radar scope is displaying aircraft moving in three dimensions. This may result in targets of aircraft at different altitudes being superimposed on each other. If all of the associated flight data is also displayed, the radar scope becomes confusingly cluttered.

This is why CAA leans toward the use of two types of displays, one pictorial (radar scope), and the other tabular (flight progress strips or equivalent.) "A beacon system with adequate coding capacity," Vickers said, "should be able to provide positive and rapid reassociation of data between the pictorial and tabular displays, greatly reducing the problem of scanning two displays to obtain complementary data."

For example, by positioning a suitable index over the blip of an unknown target on the radar scope, an automatic decoder would read-out the identity and altitude of the unknown airplane. If an electronic type of tabular display were used, such as the Hughes Typotron or

Beacon Evaluation

Civil Aeronautics Administration has expanded its ATC beacon system operational evaluation program and now plans to install ground interrogators at nine major locations: LaGuardia, New York International, Newark, O'Hare (Chicago) and Washington National airport control towers, plus Air Route Traffic Control Centers at New York International, Chicago, Washington and Norfolk, Va. Tests will begin in the spring without "defruiters" which prevent unsynchronized replies intended for other ground interrogators from cluttering the scope. Defruiting equipment will be added early in 1958, CAA says.

designers

do you have a "special" MOUNTING BASE PROBLEM?

Call in Finn. Here's a short story of two who did

ONE COMPANY isolated a delicate gyro amplifier with this unusual base. Finn-designed, it licked crucial space and weight problems with its lightweight construction and sub-miniature Finn Mounts. To MIL-C 172-B, it has company and Air Force approvals.

These are only two examples of the technical skill, experience and facilities available at Finn. An approved source, Finn can lick your "tough specials" at a competitive price. What's more, many "special" and standard mounting bases are stocked for immediate delivery.

LEAR, INC. fitted an auto pilot component way up in the TF-102's nose with this Finn base. Space envelope was extremely critical; hence, sub-miniature Finn Mounts and space-saving design. Approvals: Lear, Inc., Air Force, Air Frame. To MIL-C 172-B, of course.

For more information, write to the address below. Or call **HAwthorne 7-4100**

FINN

ELECTRONICS DIVISION

T. R. FINN & Company, Inc.
200 Central Ave., Hawthorne, N. J.

Pioneers in Lightweight Mounting Bases

Convair Charactron, the automatic decoder could flash a light opposite the flight plan data for the aircraft in question. Conversely, when the controller pushes a button opposite a specific aircraft on the tabular display, its blip on the radar scope will automatically enlarge or brighten.

More Codes Needed

The number of airborne transponder reply codes required for the automatic identification function might vary from a minimum of 64 up to a maximum of one discrete code for each transponder equipped aircraft operating in the U.S. If the minimum number were employed, the controller would have to assign a code, and the pilot would have to set it in, when the aircraft entered a new Air Route Traffic Control area. If there were more than 64 aircraft in the area, there would be some code duplication.

These problems could be eliminated by assigning an exclusive, permanent code to each aircraft. This is not as fantastic as it may appear at first glance and is well within present coding capabilities, Vickers said. It would require relatively little increase in the weight or cost of the airborne transponder, according to Vickers, but would require a more sophisticated ground decoder than that needed for a 64-code system.

The number of codes required for automatic altitude data depends upon the size of the altitude increments to be displayed. The present ATC system uses 1,000-ft. vertical separations between aircraft up to 29,000 ft. and 2,000-ft. separations above. If altitude were displayed in the same increments, 64 beacon codes could provide coverage up to 99,000-ft. altitude.

If altitude increments of 500 ft. to 29,000, and 1,000 ft. above, were displayed, it would enable a controller to learn more quickly when an airplane has vacated a former altitude assignment and reduce the delay in assigning another aircraft to the vacated altitude. However, with the smaller display increments, the 64 codes would provide coverage only up to 35,000 ft., and another 64 would be required to handle aircraft operating above this altitude up to 99,000 ft.

With altitude coding, each aircraft would be equipped with an altitude coding transducer which would automatically switch codes when airplane altitude changed without requiring any pilot action.

Getting The Codes

The present Common System airborne ATC transponder has provision for 11 different reply codes, although the design is such that this number can be increased to 64 with only insignificant

There's Plenty of SPA* *at*

AIRWORK (IN MIAMI)

THIS BASE IS A MAJOR SUPPLIER TO THE AIRLINES... AS WELL AS BUSINESS AVIATION. FACTORY-NEW SPARE PARTS FROM MOST LEADING MANUFACTURERS OF ENGINES AND ACCESSORIES ARE STOCKED HERE.

Phone Jerry Church or Bob Fleury at TUxedo 8-3467 for next truck deliveries. Or Write P.O. Box 194, Miami, Florida.

*Spare Parts Availability

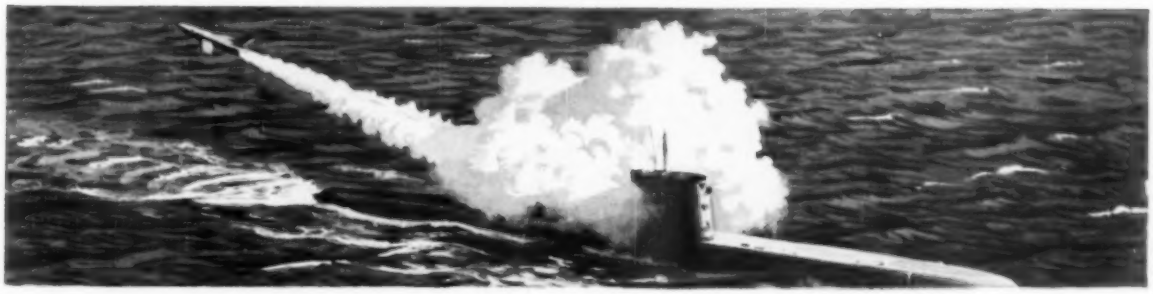
Airwork CORPORATION

ALEXANDRIA • CLEVELAND
ATLANTA • MIAMI • NEWARK

Computer Read-Out

New speedy computer read-out device, developed by Stromberg-Carlson (San Diego), can produce up to 10,000 characters/numbers per second. Model 100 uses Charactron cathode ray tube whose face, displaying computer output information, is photographed by special 35 mm. camera at frame rates up to 10%. With slower rate of one frame every two seconds, device can automatically develop and fix film, then display it on monitor screen for visual checking. First unit has been delivered to Johns Hopkins University.

1 Submarine surfaces near enemy coast...



2 ...launches *Regulus* guided missile...

3 ...*Regulus* streaks toward target...

4 ...submarine dives, no trace remains.

Airborne Thunder

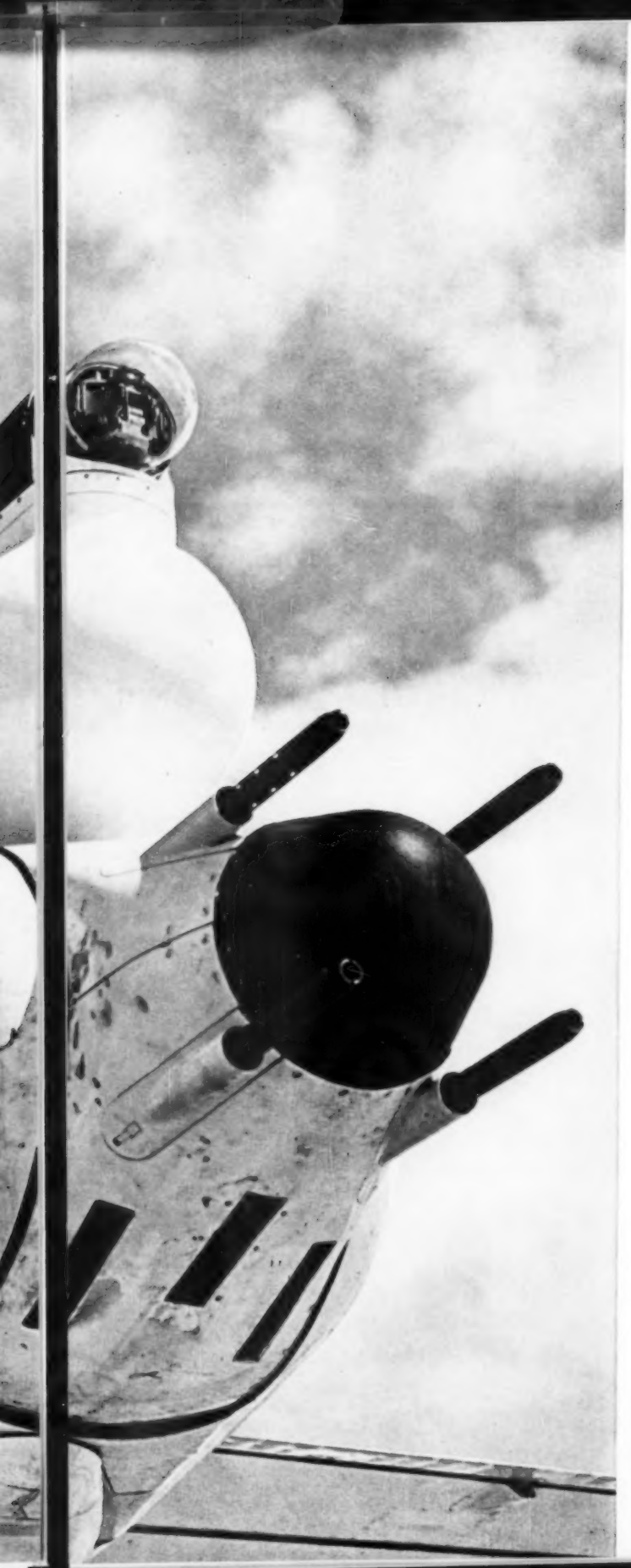
for the Silent Service

Regulus guided missiles now make aircraft carriers out of Navy submarines. This new weapons team is typical of Navy's Nuclear Age tactical power. Carried invisibly to enemy shores, launched against a target far inland, *Regulus* gives your New Navy an *intercontinental capability today!* Designed and built by Chance Vought Aircraft, *Regulus* is a prime example of the dependability and accuracy that makes new Navy weapons and techniques increasingly important to a strong U. S. Defense Team.

Scientists and Engineers: There is a challenging place for you on Vought's creative team now. For details write: J. W. Larson, Assistant Chief Engineer, P. O. Box 5907, Dallas, Texas.

CHANCE VOUGHT AIRCRAFT
INCORPORATED · DALLAS, TEXAS

DESIGNER AND BUILDER OF HIGH PERFORMANCE MILITARY AIRCRAFT SINCE 1917



The fatal sting...

defending the B-52 intercontinental bomber is the Arma MD-9 fire control system that picks up, tracks, and with uncanny accuracy fires at its target.

Developed and produced by Arma, the MD-9 is just one of Arma's capabilities in advanced weapon systems.

If you have an "ARMAment" requirement, or would like to work with a leading engineering team, contact ARMA . . . Garden City, N. Y. A division of American Bosch Arma Corporation.

ARMA

Division of American Bosch Arma Corporation

ADVANCED ELECTRONICS FOR CONTROL

KAMAN HOK-1

The Helicopter You FLY LIKE A PLANE...

Pilots who have never been in a helicopter before are amazed at the ease with which the Kaman HOK-1 can be flown. Any pilot familiar with fixed wing aircraft can fly the HOK-1 and fly it well.

The KAMAN *Aircraft Corporation*

BLOOMFIELD, CONNECTICUT, U.S.A.

modification. The Aeronautical Radio Inc. transponder specification recognized the possible future need for more codes and made the necessary design provisions.

If the Defense Department and Air Coordinating Committee were to authorize the use of all 64 of these available codes, they could provide either the 1,000/2,000 ft. increment altitude coding or the non-exclusive identification coding, but not both.

However, additional reply codes can be obtained without major redesign of the ATC transponder. Perhaps the most obvious way is to use two (or more) ground interrogation codes. The present airborne transponder replies only to a single ground interrogation code, but the Arinc specification makes provision for a slight modification which would enable the unit to reply to other ground interrogation codes.

If this approach were used to expand present code capacity, the ground beacon might transmit two interrogation codes, one eliciting an identification reply from an airplane transponder, the other bringing altitude information.

Two Pulse Trains

Another possibility is to modify the airborne transponder to reply to an interrogation with two pulse trains. The first would give airplane identity, followed by one giving airplane altitude.

The present transponder reply consists of four pulses. (See sketch, p. 77.) The first and fourth pulses, called framing pulses, are located 20.3 microseconds apart. The second and third, or information pulses, are spaced in increments of 2.9 microseconds. If the two information pulses were spaced in increments of 1.45 microseconds, this could theoretically increase the number of different codes from 64 to 8,192. (Stewart Warner says its ATC Transponder has provision for 1.45 microsecond information pulse spacing.)

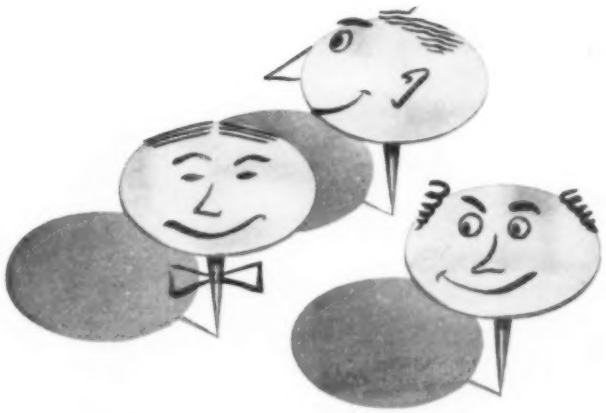
However, it is doubtful whether all of these 8,192 possible codes could be used because such close pulse spacing might raise decoding problems and the possibility of decoding errors.

The Air Navigation Development Board's Advisory Group No. 2 currently is discussing the operational requirement for increased beacon codes and the possibility of obtaining more codes.

The situation is complicated by the fact that the civil beacon system must be compatible with the military beacon system. Thus additional codes can not be made available without approval of the Defense Department.

TDC's studies indicate that the presently available 11 transponder codes are not adequate to exploit the full potential of the beacon system. There is reason to believe the number of codes will be increased to 64, or more.

Our Engineers are sharp as tacks



and they hold down pretty good jobs

Engineers are a big part of the picture at Kaman. They realize the importance of their job, and take pride in doing it and doing it well.

Intelligence, imagination and hard work are required of every Kaman engineer. The ability to channel these qualities toward a productive end has earned great respect for the Kaman engineering staff. It is, of course, apparent in the many pioneering steps taken by Kaman in the helipcoter field, as well as in the field of research and development, where Kaman is working on many classified projects.

Naturally, men with outstanding ability expect to be rewarded, and Kaman obliges with top level salaries, unlimited opportunities and the satisfaction of working where progressive thinking is being applied every day.

If you'd like to sail along at a faster clip, take a new tack — check the position you can fill and return the coupon with a brief resume, if possible, *now*. Have we made our point?

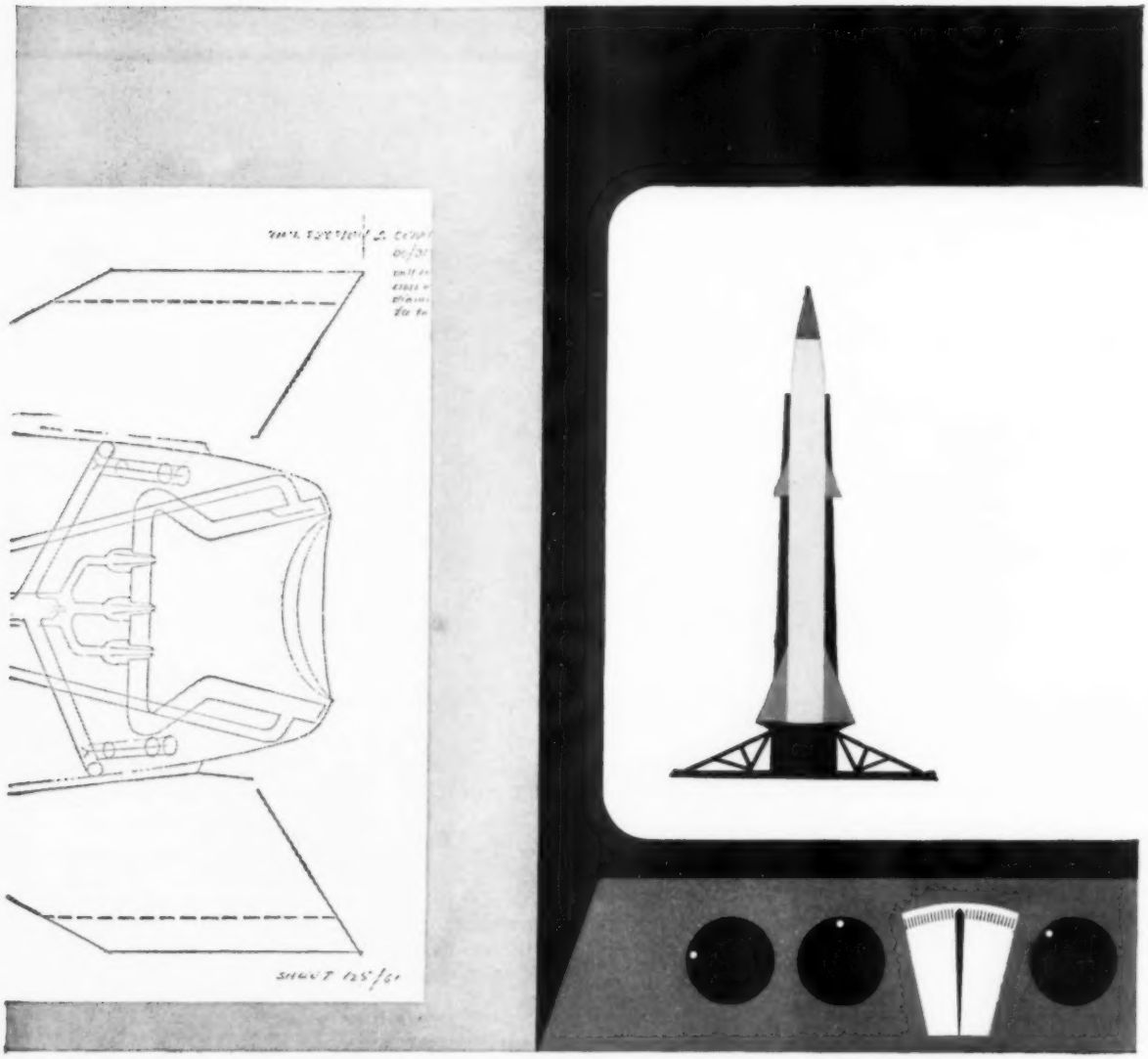
KAMAN

THE KAMAN AIRCRAFT CORP.
71 Old Windsor Road
Bloomfield, Conn.

Att: W. M. Tynan, Administrative Engineer

Name_____
Address_____
City_____
State_____
Home Phone_____

☐ Aerodynamics
☐ Design Drafting & Layout
☐ Dynamics
☐ Electrical Design & Layout
☐ Electronics
☐ Liaison
☐ Mechanical Design
☐ Preliminary Design & Research
☐ Stress Analysis
☐ Systems Development
☐ Structural Design
☐ Test & Development
☐ Thermodynamics
☐ Weights



From sketch-out to check-out

AMF has missile experience you can use

● AMF today plays a part in more than half the missile programs under way. One of its subsidiaries, Associated Missile Products Corporation, is the only private firm devoted exclusively to missile support equipment. And AMF activities cover practically every stage of design, development, and production... including mechanical and electronic test equipment... auxiliary power supplies... field and depot handling equipment... launchers... ground and flight control systems ● See for yourself why AMF's experience in missiles, as well as in a host of other fields, has made it the "can do" company.

Research, Development, Production in these fields:
- *Armament*
- *Ballistics*
- *Radar Antennae*
- *Guided Missile Support Equipment*
- *Auxiliary Power Supplies*
- *Control Systems*

Another AMF Product
DEFENSE PRODUCTS

Defense Products Group
AMERICAN MACHINE & FOUNDRY COMPANY
1101 North Royal Street, Alexandria, Va.

Russia Calls For Elimination of Aircraft Instrument Shortcomings

Russia has called for prompt and decisive action to eliminate "serious shortcomings" in aircraft instrumentation.

The move followed an investigation into Red Air Force charges that new Soviet instruments often do not meet operational needs and are incorrectly positioned in the cockpit. Pilots also complained that bureaucratic red tape and intra-industry jealousies caused long delays in introducing improved instruments.

Red Star, official organ of the USSR's Ministry of Defense, said the Air Force's protests were found to be fully justified. In the future, it declared, instrument designers must work more closely with those who use their products.

"If designers would consult with flying personnel before permitting new instruments to go into quantity production and to be installed in aircraft, many of our troubles would be avoided. We would have fewer bugs that later turn up in aircraft operation and prevent us from mastering new technology."

Improved Gyro-Horizon

One example of instrument designers' inattention to the requirements of flight crews involved introduction of an improved gyro-horizon, *Red Star* declared.

"For some unknown reason, the designers reversed the arrangement of this instrument The semi-circle that should indicate the sky was put in the lower half of the gyro-horizon, and the semi-circle indicating the ground was placed in the upper half.

"Pilots argued that such a marking arrangement was unreasonable, being a departure from practice developed by airmen over the course of many years. But the designers remained deaf to the complaints for a long time. Only after great effort were they convinced that the flying personnel were correct."

In many cases, *Red Star* continued, builders of new Soviet planes, engines, instruments and equipment have overlooked the importance of design "trifles." As a result, it said, operation of otherwise excellent aircraft is not only made more difficult but, at times, the safety of flight itself is threatened.

"Take windshield wipers for example," the newspaper went on. "They are particularly necessary during take-off and landing in bad weather. Yet several of our aircraft types lack such equipment.

"In this connection, we hear many justifiable complaints from our pilots. But the designers ignore them, apparently believing that windshield wipers are "trifles" which are out of harmony with the aircraft's composition.

Landing Gear Switch

"Here's another example. On a recent long-distance flight the landing gear on one of our aircraft did not fully retract, and the plane's fuel consumption became excessive.

"It turned out that the designer had placed an electric (over-ride) switch for the landing gear under a small housing where it could not be used. Such is the price of an innovation introduced without considering practical flight requirements.

"Many such difficulties, particularly those associated with location of knobs, buttons, switches and control levers, could be prevented if designers had closer contact with pilots, navigators, gunners and radiomen. At times, designers consider only the technical aspects of their jobs and neglect the practical side.

"One designer put a military plane's radio transmission button on the control panel. This proved very inconvenient for the pilot, especially during group maneuvers when a hand must be kept in the area of the throttle.

"Recognizing the danger of this arrangement, the pilots demanded that the radio transmission button be shifted nearer the throttle. But the designer was stubbornly silent. It took nearly three years to get this insignificant change made.

Intercom Switch

"A similar case on another plane involved the intercom switch. It was located some distance from the pilot, who had to take his right hand off the controls to operate it.

"Pilots requested the designer to move the intercom switch to the left side of the cabin, where it would be more convenient. But the designer maintained this was not necessary, and the trouble still exists.

"Flight personnel have repeatedly asked that the landing light switches be better located. The designer, positive that his idea is best, has remained adamant."

According to the Russian Defense Ministry, many of the new ideas conceived in Soviet instrument design bureaus are implemented with difficulty.

"New concepts are held back in some narrow bureaucratic channel. Valuable design proposals must pass through long, drawn-out stages of official ap-

BIG or SMALL

they all

SHINE BEST

SHINE LONGER

SHINE EASIER with

NEVR-DULL

Aluminum Cleaner and Polish

The original chemically-impregnated cotton wadding — Cleans quicker, gives higher, longer-lasting gloss, leaves protective film. Saves time, labor and money! Avoid inferior imitations.

AVAILABLE AT LEADING DISTRIBUTORS

MANUFACTURED EXCLUSIVELY BY

George BASCH Co.

559 Longfellow Avenue, New York 59, N. Y.

ENGINEERS EXPAND YOUR FUTURE AT RYAN

Join a fast-growing company pioneering in research aircraft—jet-propulsion—electronics. Work on

Jet VTO
Automatic Navigation
Missile guidance
Rocket combustion
High-temperature metallurgy
Advanced aerodynamics

Join a 34-year old company—not too big—not too small—where you will get broad experience, advance rapidly. Live in clear-sky San Diego, only minutes from work, beaches, mountains, parks.

Write in confidence to James Kerns.

RYAN

AERONAUTICAL COMPANY

2720 Harbor Drive

San Diego 12, California

AIR-SUPPORTED FABRIC ANTENNA

In less than one hour, this small crew can assemble the revolutionary Paraballoon antenna from these few parts. They will place the tripod directly on the ground.

PROVIDES FRONT-LINE SUPPORT IN MINUTES

One hundred and twenty minutes after the site is selected, high-power radar using a new, extremely portable antenna can be scanning the skies. This revolutionary, lightweight antenna has been developed by Westinghouse Electronics Division for the Rome Air Development Center.

The Paraballoon® antenna is blown up like a balloon! It maintains its shape with only slightly more than atmospheric pressure. Two fiberglass paraboloids—one of which is coated with vaporized aluminum—are zipped together to form the 30-foot antenna. In comparison with equivalent conventional antennas, the Paraballoon has shown weight advantages as much as 10 to 1.

The antenna retains its accurate contour no matter how many times it is erected and dismantled, so no contour checking is required in the field.

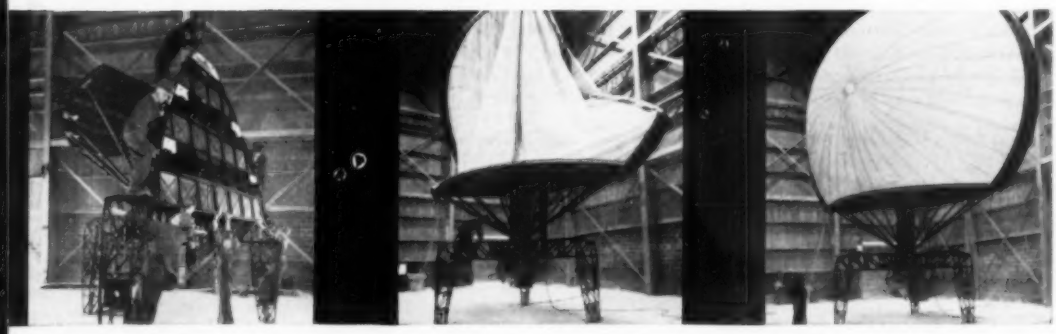
Major General Stuart P. Wright, Commander of Rome Air Development Center states: "This outstanding development is a major break-through in the design of ground electronics equipment. The air-inflated Paraballoon antenna is the key to a large and truly mobile radar set. It is now possible to employ high-power radars in tactical situations and locations where time and transportability are of utmost importance."

Design and development of advanced electronic equipment are only part of the service available to you from Westinghouse. For complete information about Westinghouse capacity to produce tomorrow's electronic equipment today, contact your Westinghouse sales engineer or write: Westinghouse Electric Corporation, Electronics Division, Friendship International Airport, Baltimore, Maryland.

J-02300

YOU CAN BE **SURE**...IF IT'S

Westinghouse



Here, the crew has assembled the antenna tripod. With a block and tackle attached to the radome crown piece, they are positioning the antenna base.

The paraboloids are zipped to a two-ply neoprene-nylon tube. This tube forms a stiff arch—the main structural member of the balloon—which holds the inflated antenna in position.

The 30-foot antenna shown here, ready for operation, weighs only 1690 pounds complete with its base and tripod. It will rotate at 6 rpm driven by a ¼-hp motor.

Gear teeth get in line when he takes a hand

R. L. Thoen, right, explains faulty tooth conformation on a minute gear which has been enlarged 100 times in this king-sized projector. Gear specialist on the engineering staff of the Mechanical Division of General Mills and author of numerous technical papers, Thoen makes gear trains perform with uncanny accuracy. He helps design and build the special machines which make such accuracy routine work at the highly specialized plant.

Next to its men, General Mills is most proud of its machines. For it is this combination that mass produces gear trains with nearly imperceptible backlash, total cumulative error of 0.0002 inch, angular tolerances within 40 seconds of arc, positioning accuracy within 0.01 percent.

This typical General Mills precision production is possible only because men like Thoen have improved standard tools, created special machines, devised ingenious attachments. Some equipment is operated under strict temperature-humidity control. All is backed with the finest inspection devices. You can use these machines and the men that created and operate them to produce your precision products. You'll profit. A simple request brings more facts.

Booklet Tells More—Send Today

Learn how our men and machines eliminate irksome production problems. Write Dept. AW111, Mechanical Division of General Mills, 1620 Central Ave. N.E., Minneapolis 13, Minn.

General Mills Pioneers Scientific Frontiers One of General Mills' numerous research projects involves the behavior of metals in space flight. Here a scientist determines the "sputtering" or disintegration rate of molybdenum at 200 miles above the earth. The metal is under fire from atoms moving at 25,000 m.p.h.

MECHANICAL DIVISION OF General Mills

CREATIVE RESEARCH AND DEVELOPMENT + PRECISION ENGINEERING AND PRODUCTION

proval. As a result, some instruments get obsolete before they see the light of day.

"Complications have developed regarding the signal indicating the landing gear's position. Formerly a quick glance was sufficient to determine whether the gear was up or down. But the simple (mechanical) signal was later replaced by small control lights.

"It has become more difficult for pilots to work with these lights. It is difficult to figure out what considerations motivated the designers in installing them, since a large number of vari-colored lights sometimes distract flight personnel."

Information Exchange

Red Star said opinion is growing that Russian instrument designers fail to exchange essential information among themselves, each one working on his own.

"Let us say some instrument or device is installed on a plane and proves itself to be highly satisfactory in actual practice. It would seem that the same instrument should also be employed for new type planes. But such is not the case.

"Designers consider it unworthy of them to use the experience of comrades in the same profession. They always strive to create something of their own.

"The duplicative new device must then undergo a long period of tests, in which difficulties show up and much time is spent eliminating them. And, in many cases, the new instrument turns out to be inferior to the old one already in use, causing more difficulties for flight personnel."

Soviet designers also have been slow to standardize the location of cabin instruments, knobs, buttons, signals and switches, the Russian military organ declared. Past practices are often disregarded.

"Sometimes planes of the same design and even of the same series have instruments, switches and control knobs in different places. All this inconveniences the pilot and complicates his work.

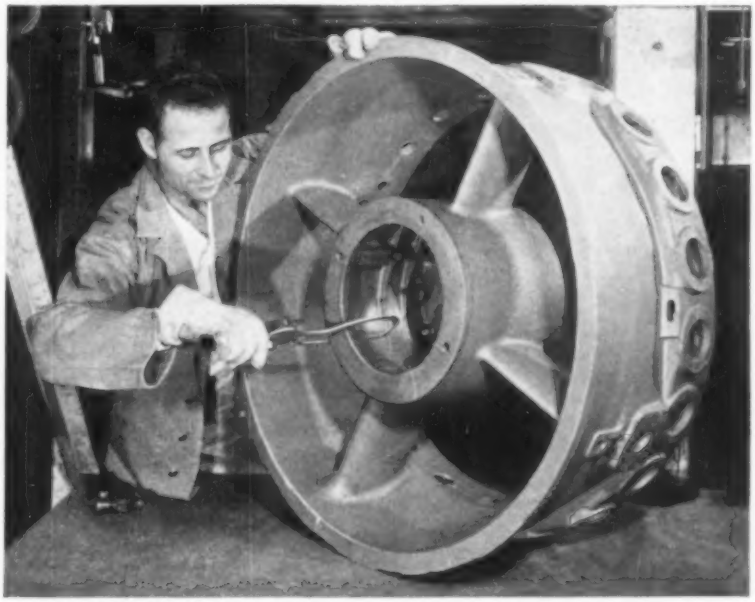
"Maybe it isn't necessary to standardize the cabins of different classes of aircraft. But on planes of the same type, uniform positioning of equipment must be observed."

Red Star said that variations in location of equipment and instruments are an especially serious problem in training fighter pilots.

"Trainees become accustomed to a certain position for control levers, knobs and switches in two-place aircraft. But as soon as they change over to single-place planes they find that the setup they are familiar with is changed, and a new arrangement must be learned.

"Such problems could be avoided if

QUALITY MAGNESIUM CASTINGS



A MAGNESIUM SAND CASTING at the Dow foundry. Many kinds of castings are produced—with quality standards to meet the special needs of the aircraft industry.

. . . *for the Aircraft Industry!*

ORDINARY AND EXTRAORDINARY SAND CASTINGS

PERMANENT MOLD CASTINGS

PLASTER CASTINGS

YOU NAME THE CASTING, Dow can supply you with any shape or size required. Specialized inspection techniques rigidly maintain your standards and specifications. Heavy-wall or thin-wall, the best—and surest—answer to your problems are Dow magnesium castings! Contact your nearest Dow sales office for additional information.

THE DOW CHEMICAL COMPANY
Foundry Sales, Bay City, Michigan

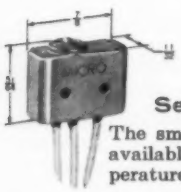
DOW

MICRO precision switches

...THEIR USE IS A PRINCIPLE OF GOOD DESIGN

The ever critical aircraft switch problems of weight...space...altitudes...temperatures are continuously met by MICRO SWITCH Engineering

Cylindrical environment-free switch:
A compact, completely sealed switch for use on landing gears, flaps or other exposed locations.



Sealed subminiature switch:
The smallest lightweight switch of this type available. Gives trouble-free operation in temperatures between −65°F and +180°F.

Selection of the proper switch to meet any aircraft application is simplified by the wide variety of MICRO SWITCH types, shapes, sizes, actuators and electrical characteristics.

Whether your switch must be housed in a protective metal enclosure or sealed hermetically, whether it must control single or multiple circuits —if your design requires a precision switch of extreme reliability, small size and light weight, call MICRO SWITCH.

Illustrated are but a few of the hundreds of the precision switch types MICRO SWITCH Engineering has developed to meet aircraft design requirements. All are ruggedly housed or sealed against environmental changes and exposures. It pays to bring your switch problems to MICRO SWITCH.

For complete information on the complete line of aviation switches contact the MICRO SWITCH branch office near you.

MICRO SWITCH

A DIVISION OF MINNEAPOLIS-HONEYWELL REGULATOR COMPANY

In Canada, Leaside, Toronto 17, Ontario • FREEPORT, ILLINOIS

the same equipment were placed in the front and rear cockpits of training planes and if the cockpit of military trainers conformed to the cockpits of combat planes."

Red Star also complained that problems involved in unifying the operation of certain instrument groups in high-speed aircraft are being solved "very slowly" in the USSR. It said that increasing numbers and varieties of instruments make control automation essential for fast, modern aircraft, since their pilots have no margin of time for hesitation.

Expansions, Changes In Avionics Industry

General Electric will establish headquarters at Phoenix, Ariz., for its recently formed Computer Dept. Key management and engineering personnel will move from Syracuse to leased quarters in Phoenix early next year. New operation will develop computers for military, business and industrial use. Computer Department's Menlo Park, Calif., ERMA System Laboratory, established when GE took over the production of the Electronic Recording Machine Accounting (ERMA) system developed by Stanford Research Institute, will remain in present location.

Other recently announced industry changes and expansions include:

• **Davies Laboratories, Inc.,** maker of tape data handling systems, has moved into new plant at Beltsville, Md., which provides a three-fold increase in floor-space. New address: 10721 Hanna St., Beltsville, Md.

• **Waltham Watch Co.,** Waltham, Mass., intends to expand its aircraft instrumentation activities under new management team headed by President Joseph Axler, which recently acquired control of the company.

• **Electronic Engineering Co. of California** has broken ground for its new 41,000 sq. ft. facility at 1601 E. Chestnut St., Santa Ana.

• **Sprague Electric Co.,** North Adams, Mass., will move its Washington office to larger quarters in Suite 624, Victor Bldg., 724 Ninth St., N.W. John P. Sheridan, coordinator of government liaison will move from North Adams to new offices in Washington.

• **Cossor Communications Co., Ltd.** is name of newly formed subsidiary of A. C. Cossor Ltd. The new British company will specialize in radio and telecommunications.

• **Bocing Airplane Co.** has sold its analog computer enterprise to Western

5 HEADS *for the Reconnaissance Pilot?*

Instrument position on control panel depends on importance. This is a typical C. A. I. Viewfinder "center" installation.

How else to line up on target, fly the aircraft over the target, pinpoint the camera coverage, watch the flight instruments and monitor the camera controls—simultaneously!

Chicago Aerial's answer: utilize ground area as another flight instrument. The Periscopic Viewfinder permits the pilot to see through the airplane, and makes visible the ground area below and ahead—the area most vital to photo-navigation. With its selective wide angle and narrow angle views, the Viewfinder gathers this light, directs the ray bundles through narrow enclosures, and sends all the light to the pilot's eyes. With CAI's Viewfinder the brilliant, distortionless image preserves the natural color and fine detail of the ground below . . . so valuable for navigation and target detection and recognition.

Long or short eye relief . . . magnification or minification—these and other parameters are tailored to particular aircraft requirements. From research through manufacture, the Viewfinder is exclusively C.A.I.—only one of a long list of accomplishments.

Look to CAI for research, enginering, and manufacturing of airborne optical systems.

Learn about the opportunities waiting for you in the Military Air. Visit or write your nearest Naval Air Station or Air Force Headquarters.

If you are interested in the unique C.A.I. story, we suggest you write for our 24-page brochure, "Advancing Horizons."

CHICAGO AERIAL INDUSTRIES

1980 Hawthorne Avenue, Melrose Park, Illinois
Chicago Office: 332 South Michigan Avenue, Chicago 4, Illinois

Electronic Supply Co., Seattle, giving the latter full rights to make and sell the Boeing-developed computer.

• **Christie Electric Corp.** is adding 5,000 sq. ft. to present headquarters at 3410 West 67th St., Los Angeles.

• **MB Manufacturing Co.** has opened new western field service office at 10816 Washington Blvd., Culver City, Calif. New office is headed by A. C. Deichmiller.

• **Kentron Hawaii, Ltd.,** is name of Hawaii's first electronics firm which will manufacture cathode ray tubes and develop military electronic field support equipment. New firm is headed by Donald C. Kenney, formerly of Los Angeles.

• **United States Naviguide Corp.** is name of newly formed Akron, Ohio firm which will make lightplane VHF transmitters weighing only 5 lb. Naviguide Corporation is headed by Robert J. Paradis. Address: 1041 Kenmore Blvd.

• **Electromation Co.,** Santa Monica, is building new 10,000 sq. ft. facility at 1646 18th St. to house its Cado and Kinevox divisions.

Dear Lynn: Thought you'd like this Texas-Size postcard of the $4,000,000 Texas-Size layout Southwest Airmotive is building for business airplanes. Much of it will be ready in '57 in time for SAC's 25th Anniversary. Wish I could join you as you putter around in your gingham apron cookin' that Thanksgiving turkey. I'll bet it takes a lot of drumsticks for my 23-yr.-old, 128 lb., 5'8", blonde, blue-eyed Texas-Size chefess!

Love, Daddy

SOUTHWEST AIRMOTIVE CO. • LOVE FIELD • DALLAS, TEXAS

FILTER CENTER

► **Direction-Sensing Photocell**—A semiconductor photocell which produces two signals, one proportional to light intensity and the other proportional to the angle of incidence of the light beam, has been announced by Radio Corporation of America. New device stems from discovery that when light strikes on either side of the center of a semiconductor junction, it generates a small voltage along the length of the junction in addition to the familiar voltage across the junction. New RCA device should permit simplified photocell tracking devices.

► **Symbolic Logic**—Institute of Radio Engineers has formed committee to standardize symbols used in computer block diagrams to eliminate present confusion resulting from different manufacturer's practices. To extend representation beyond group's nine-man membership, it seeks a number of "correspondents" representing manufacturers, government agencies and universities, who will receive and comment on all proposals but will not ordinarily attend meetings. Interested parties, or companies who wish to submit their present symbol standards, should write to Mr. G. W. Patterson, Chairman Subcommittee 8.9, c/o IRE Headquarters, 1 East 79th St., New York City.

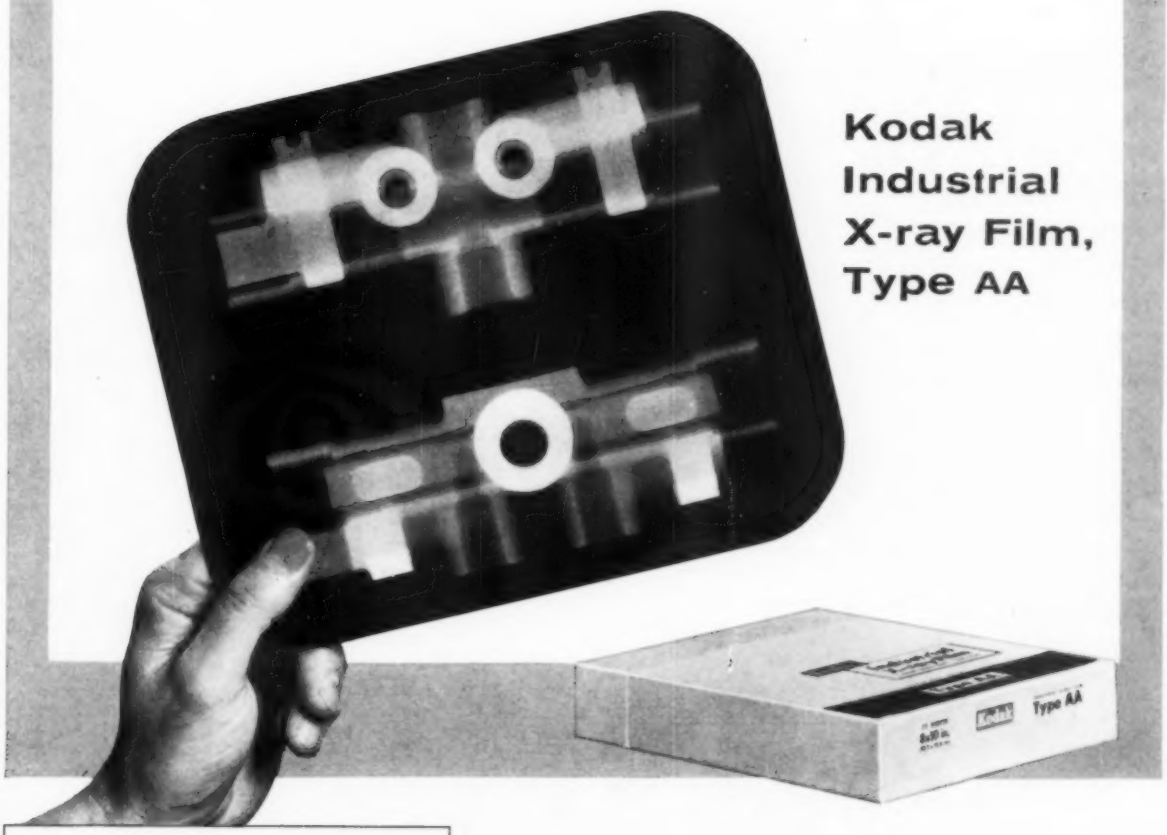
► **Transistorized Nav-Computer**—Transistorization has cut weight of Canadian rho-theta navigation-interception computer, developed by PSC Applied Research Ltd., from 45 to 29 lb., with comparable size reduction. Company received $3 million order for the computers from Canadian Government. Device will be used on CF-100's and is under evaluation by several NATO air forces and international airlines.

► **Drones Their Target**—Babcock Radio Engineering, Inc., identified in Aviation Week's Oct. 8 story on the Army's new QL-17 television drone as the supplier of the radio control equipment and as a builder of radio control equipment for model airplanes advises that the latter comprises "less than 5% of our total effort." Company says it has supplied "major quantity" of radio control equipment for small target drones of the OQ-19 and KD2R-3 class since 1948.

► **B-58 Defense**—Passive defense system (electronic countermeasures) for the Convair Hustler is being supplied by Sylvania Electric Products, Inc. Work is being carried out at several Sylvania facilities located at Buffalo,

New X-ray Film

gives greater detail with usual exposure times



Kodak Industrial X-ray Film, Type AA

Read what the new Kodak Industrial X-ray Film, Type AA, will do for you.

- Reduces exposure time—speeds up routine examinations.
- Provides increased radiographic sensitivity through higher densities with established exposure and processing technics.
- Gives greater subject contrast, more detail and easier readability when established exposure times are used with reduced kilovoltage.
- Shortens processing cycle with existing exposure technics.
- Reduces the possibility of pressure desensitization under shop conditions of use.

Now your x-ray dealer can supply you with this new x-ray film that gives you greatly increased speed. This gives you the opportunity of using reduced kilovoltage to obtain greater radiographic contrast, and easier readability with established exposure times.

And in addition to ranging up to more than double the speed, this new film retains the fine sensitivity characteristics which have made Kodak Type A the most widely used x-ray film in industry.

Kodak Industrial X-ray Film, Type AA, will save you time. It can produce finer work. Get in touch with your x-ray dealer or Kodak Technical Representative and see how.

EASTMAN KODAK COMPANY
X-ray Division
Rochester 4, N. Y.

Kodak
TRADE MARK

The emphasis is shifting

It used to be that you would design an airframe for payload—and provide *minimum* required instrumentation.

The emphasis is shifting.

In this new age of electronic missile guidance and identification, the chicken is now the egg and the cart pulls the horse. Instrumentation comes first—after which a mobile container is designed that will carry it with greatest efficiency.

This shift finds the sturdy shoulders of Stewart-Warner Electronics braced for the greater load. Stewart-Warner has pioneered in electronics for thirty years. Today, S-W Electronics is pioneering in the stratospheric electronics of tomorrow.

STEWART SW WARNER **ELECTRONICS**

a Division of Stewart-Warner Corp.
1300 N. Kostner Ave., Chicago 51, Ill.

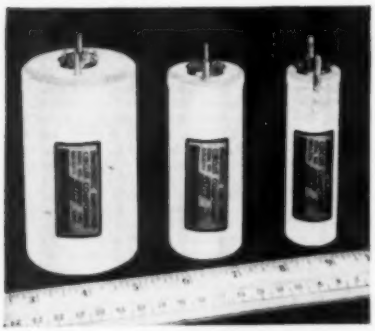
Waltham, Mass., Mountain View, Calif., and Bayside, N. Y.

▶ **Radar Clutter Remover**—New technique which automatically reduces gain of a radar amplifier for ground clutter signals to prevent them from obscuring small targets has been developed by Government Division of Allen B. DuMont Laboratories. New technique, called Clutter-Operated Anti-Clutter (COAC) attenuates strong signals having large dynamic range by as much as 80 db., while preserving high incremental gain for signals of narrow dynamic range, DuMont says. An airborne radar with a COAC amplifier has been flight tested successfully. COAC technique also is applicable to ground or shipboard radars, DuMont says.

NEW AVIONIC PRODUCTS

Components & Devices

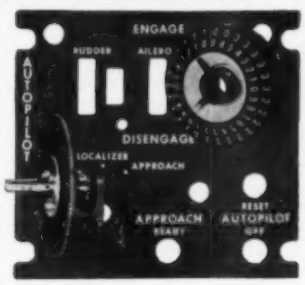
• **Magnetic amplifiers,** available in three power ratings covering the range of 1.5 to 300 watts, 60 or 400 cps, reportedly meet MIL specs. The 300 watt, 400

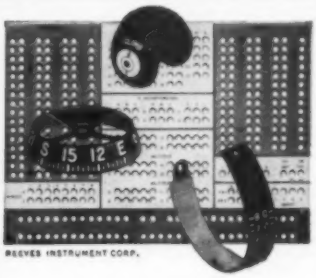


cps unit measures approximately 3 in. dia. x 4 in. long. Design bulletins available on request. Adler Electronics, Inc., One LeFevre Lane, New Rochelle, N. Y.

• **Precision film-type glass resistors,** Type S, capable of operating at temperatures of 200C, are now available in extended resistance ranges. The ½-watt resistor comes with resistances up to 100,000 ohms, the 1-watt to 400,000 ohms and the 2-watt to 1 megohm. Units have temperature coefficient of 300 ppm/Deg. C. and reportedly meet MIL-R-11804B. Corning Glass Works, Corning, N. Y.

• **Miniature variable-frequency blower motor,** single-phase, 4-pole, can operate from 115 v., 400 to 1,800 cps power at speed of 7,800 to 11,000 rpm with 2-in. blade fan, or at frequency of 300 to 1,000 cps, at speed of 4,400 to 5,200 rpm with 3-in. fan. Motor, Type 11-A-





have you considered
EDGE LIGHTING?
At U.S. Radium, plastic edge-lighted instrument panels are produced by precision photographic processes. The flexibility and accuracy inherent in these methods enable us to follow your design parameters closely, and with a minimum of gadgetry and substandard devices, produce a crisp-looking, functionally precise unit which easily satisfies spec MIL-P-7788. For data, write dept. AW11L

or do specs call for
SHEET STOCK PANELS?
Produced in metal or plastic in a wide variety of configurations and finishes. For applications ranging from computer arrays and aircraft control to domestic radio panels and control dials for kitchen blenders. Luminous and multi-colored finishes and markings available. Facilities for complete fabrication from raw materials permit consistently high degrees of angular and dimensional accuracy. For data, write dept. AW11P

UNITED STATES RADIUM CORP.
Hanover Ave., Morristown, N. J.
4624 W. Washington Blvd., Chicago, Illinois
5420 Vineland Ave., North Hollywood, Calif.
RADIUM
Affiliates
CANADA: Radelin-Kirk Ltd., 1168 Bay St., Toronto, Ont.
EUROPE: United States Radium Corporation (Europe), 36 Avenue Krieg, Geneva, Switzerland.

ACCURATE—HIGH SPEED
TELEMETERING SWITCHES
LIGHT WEIGHT
RELIABLE
COMPACT
This new ASCOP model provides high quality switching of low level signals under extremes of shock and vibration. Withstands 50 G acceleration. The one pole wiper samples 60 contacts at 10 RPS and operates at low noise levels. ASCOP has the solution to any switch problem... over 200 available models for a wide variety of applications. A staff experienced in telemetering, instrumentation, data handling, etc. Rely on the leader...
APPLIED SCIENCE CORP. OF PRINCETON
P. O. Box 44, Princeton, N. J. • Plainsboro 3-4141
1641 S. LaCienega Blvd., Los Angeles, Calif.
Crestview 1-8870
ASCOP
WE PROVIDE THE LEVER · YOU MOVE THE WORLD

Everywhere—but everywhere—there's a helpful *-hp-* engineer

Throughout North America, in Europe, Australia, and other parts of the Free World, there is a Hewlett-Packard representative to serve you. Each of these men is extensively trained at the *-hp-* plant, periodically retrained, and brought completely up to date on new instrumentation and techniques at an annual engineering seminar.

For your added convenience, factory-level service and repairs are also available at points throughout the U. S. and in Europe. This service is available in cities marked (■) in adjoining column.

HEWLETT-PACKARD COMPANY

3832E PAGE MILL ROAD • PALO ALTO, CALIFORNIA, U.S.A.
CABLE "HEWPACK" DAVENPORT 5-4451

hp means complete coverage in service, too!

-hp- Sales Engineers in:

EASTERN SEABOARD

Asbury Park, N. J., I. E. Robinson Co., 702 Mattison Ave., DU 9-2404. **Bogota, N. J.,** R.M.C. Associates, 114 E. Main St., DI 2-5343. **Bridgeport 8, Conn.,** Yewell Associates, Inc., 1101 E. Main St., FO 6-3456. **Camp Hill, Pa.,** I. E. Robinson Co., 2120 Market St., RE 7-5541. **New York 21, N. Y.■,** R.M.C. Associates, 236 E. 75th St., TR 9-2023. **Syracuse 2, N. Y.■,** J. D. Ryerson Associates, Inc., 412 E. Genesse St., SY 76-8344. **Upper Darby, Pa.■,** I. E. Robinson Co., 7404 West Chester Pike, SH 8-1294. **Waltham 54, Mass.■,** Yewell Associates, Inc., 751 Main St., TW 3-7420. **Washington 9, D. C.■,** Horman Associates, Inc., 2017 S St., N. W., DE 2-5705.

SOUTHEASTERN STATES

Atlanta 5, Ga., Bivins & Caldwell, 3133 Maple Dr., N.E., CH 7522. **Fort Myers, Fla.,** Arthur Lynch & Associates, P. O. Box 466, ED 4-4431. **High Point, N. C.,** Bivins & Caldwell, Security Bank Bldg., 3672.

CENTRAL STATES

Chicago 40, Ill.■, Alfred Crossley Associates, Inc., 4501 No. Ravenswood Ave., UP 8-1141. **Cleveland 21, Ohio,** S. Sterling Co., 4311 Mayfield Rd., EV 2-4114. **Dayton 9, Ohio,** Alfred Crossley Associates, Inc., 53 Park Ave., OX 3594. **Detroit 33, Mich.■,** S. Sterling Co., 15310 W. McNichols Rd., BR 3-2900. **Kansas City 30, Mo.,** Harris-Hanson Co., 7916 Paseo Blvd., HI 4-6744. **Pittsburgh 22, Pa.,** S. Sterling Co., 355 Fifth Ave., AT 1-9248. **St. Louis 17, Mo.,** Harris-Hanson Co., 2814 So. Brentwood Blvd., MI 7-4350. **St. Paul 14, Minn.,** Alfred Crossley Associates, Inc., 2388 University Ave., MI 5-4955.

SOUTH CENTRAL STATES

Dallas 9, Tex.■, Earl Lipscomb Associates, P. O. Box 7084, EL 5345. **Houston 5, Tex.,** Earl Lipscomb Associates, P. O. Box 6573, JA 4-9303.

WESTERN STATES

Albuquerque, N. M., Neely Enterprises, 107 Washington St. S. E., 5-5586. **Denver 3, Colo.,** Hytronic Measurements Associates, 446 Broadway, SH 4-2241. **Las Cruces, N. M.,** Neely Enterprises, 126 S. Water St., JA 6-2486. **Los Angeles, Calif.■,** Neely Enterprises, 3939 Lankershim Blvd., No. Hollywood, ST 7-0721. **Phoenix, Ariz.,** Neely Enterprises, 641 E. Missouri, CR 4-5431. **Sacramento 14, Calif.,** Neely Enterprises, 1317 - 15th St., GI 2-8901. **San Diego 6, Calif.,** Neely Enterprises, 1029 Rosecrans St., AC 3-8106. **San Francisco 18, Calif.■,** Neely Enterprises, 2830 Geary Blvd., WA 1-2361. **Seattle 99, Wash.,** Ron Merritt Co., 120 W. Thomas St., GA 6644.

CANADA

Toronto 10, Ontario, Atlas Radio Corp., Ltd., 50 Wingold Ave., RU 1-6174. **Winnipeg, Manitoba,** Atlas Radio Corp., Ltd., 505 McIntyre Bldg.

EUROPE

Belgium, Société Belge Radio—Electrique, 66, Chaussée de Ruisbroek, Forest - Bruxelles. **Denmark,** Tage Olsen A/S, Centrumgarden, Room 133, 6D, Vesterbrogade, Copenhagen V. **Finland,** Into O/Y, 11 Meritullinkatu, Helsinki. **France■,** Radio Equipements, 65, Rue de Richelieu, Paris — 2°. **Germany,** Schneider, Henley & Co. G.M.B.H., Gross - Nabas - Strasse 11, München 59. **Great Britain,** Lithgow Electronics Ltd., 1 Grange Court, Sudbury Hill, Harrow, Middlesex. **Greece,** K. Karayannis, Karitsi Square, Athens. **Italy,** Dott. Ing. Mario Vianello, Via L. Anelli 13, Milano. **Netherlands,** C. N. Rood, 37 Weteringkade, The Hague. **Norway,** P. N. Biorn, Tollbodgt, 4, Oslo. **Sweden,** Erik Ferner, Bjornsonsgatan 197, Bromma. **Switzerland,** Max Paul Frey, Laupenstrasse 2, Bern. **Yugoslavia,** Belram Electronics, 43 Ch. de Charleroi, Brussels, Belgium.

Australia, Geo. H. Sample & Son Pty. Ltd., 17 - 19 Anthony St., Melbourne C.1. Geo. H. Sample & Son Pty. Ltd., 280 Castlereagh St., Sydney. **Japan,** Seki & Co., Ltd., No. 1 Kanda Higashi—Fukudacho, Chiyoda - Ku, Tokyo. **Mexico,** RCA Victor Mexicana, S.A. de C.V., Av. Cuitlahuac 2519, Mexico 16, D. F. **New Zealand,** Geo. H. Sample & Son (N.Z.) Ltd., 431 Mt. Albert Rd., Mount Roskill S.1, Auckland. **Union of South Africa,** F. H. Flanter & Co., 4 Buitencingle St., Cape Town.

(■) Indicates factory-level service available.

8223-01, measures approximately 1 in. dia. x 2 in. long, weighs 5 oz. John Oster Manufacturing Co., Avionic Division, Racine, Wisc.

• **Subminiature electrolytics capacitor,** called Littl-Lytic, can now be operated at temperatures up to 85C and is available with working voltages of 1 to 50 v.d.c.

Bulletin 320A gives application data. Sprague Electric Co., 327 Marshall St., North Adams, Mass.

Instrumentation

• **Linear position transducer,** strain-gage type, measures only ¼ in. high permitting its use externally on aircraft without seriously disturbing airstream. Transducer can be operated over temperature range of −50C to 100C. Consolidated Avionics Corp., Stamford, Conn.

• **Magnetic tape data recorder,** 14-channel, Model TR-150-14, provides three tape speeds: 15, 30, or 60 in. per sec. Frequency response is flat within 3 db. from 200 cycles to 20 kw. at the 15 ips. speed, out to 40 kc. at 30 ips., and out to 80 kc. at 60 ips. Unit can hold 2,400 foot reel. Recorder is designed for rack mounting. Telectro Industries Corp., 35-18 37th St., Long Island City 1, N. Y.

• **Transistor video amplifier,** Model 126A, comes in plug-in modular unit complete with battery. Frequency response is 3 db. down at 20 cycles and 15 mc. when gain is set at 10 db. With 20 db. gain setting, response is down 3 db. at 20 cycles and 10 mc. Maximum output voltage is 0.15 v. at 10 db. gain setting or 0.30 v. at 20 db. setting.

Kay Electric Co., 14 Maple Ave., Pine Brook, N. J.

• **Frequency deviation meter,** Type FT-FMV, measures FM or AM modulation characteristics at carrier frequencies of 20 to 600 mc. Device can simultaneously indicate the incidental AM in an FM signal being measured or the incidental FM in an AM signal. Unit operates from 100, 125, 150, or 220 v., 40 to 60 cycles.

Federal Telephone & Radio Co., 100 Kingsland Rd., Clifton, N. J.

BOURNS

announces new TRIMPOTS® for quick assembly

130 TRIMPOT® solder-lug type

You can solder your hook-up wire direct to this instrument, and eliminate splicing. Terminals are standard flat, slotted lugs to provide fast, secure connections.

The silver-plated solder lugs are extremely rugged. Instrument is not affected by soldering iron temperatures.

205 TRIMPOT® for printed circuits

Round pin terminals on this unit may be plugged into holes in your printed circuit boards for dip soldering. Terminals are gold-plated copper, ½" long, .028" diameter, and spaced in multiples of 0.1". Mounting is accomplished by 2-56 screws through body eyelets, or by pins only.

BOTH UNITS PROVIDE a usable potentiometer range of 98%, and low residual resistance either end, 0 to 1%. Low temperature coefficient wire is utilized in the precision wirewound resistance elements.

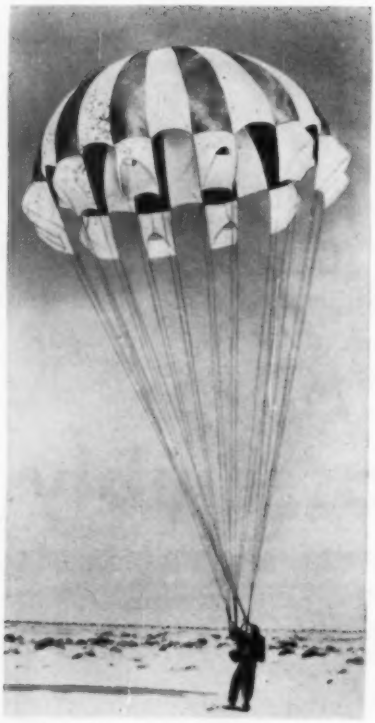
In all other design features, these instruments are similar to the original Model 120 TRIMPOT. Each is subminiature in size (1¼" x ⅜" x ¼"), and weighs only 0.1 oz. Other characteristics include 25-turn screwdriver adjustment, self-locking shaft, and excellent performance under extreme shock, vibration and acceleration. Units meet or exceed most government specifications. Delivery from stock on standard resistances. Send for Bulletins 130 and 205.

COPR. BL

BOURNS LABORATORIES, INC.

General Offices: 6135 Magnolia Ave., Riverside, Calif.
Plants: Riverside, California—Ames, Iowa

TRIMPOTS • LINEAR MOTION POTENTIOMETERS • PRESSURE TRANSDUCERS AND ACCELEROMETERS



JUMPER (above) wears oscillation-free U. S. parachute manufactured by Pioneer Parachute Co., Inc. Guide extensions (below) are sewn to the skirt of the canopy at every second gore. Vents produce air deflection for stability.

RUSSIAN blank gore parachute in use at Moscow championships last July.

U. S. Jumper Tests Russian

By George L. Christian

New York—Russian parachutes take a lot of the jar out of parachuting at the two most jarring moments—when the canopy snaps open, and when the jumper lands. They also are more maneuverable than American steerable 'chutes.

However, the Russian parachutes are much heavier and bulkier than American-made 'chutes.

These are the opinions of Jacques Andre Istel, who recently captained the U. S. Parachute Jumping Team which participated in the Third World Parachute Championships at Moscow (AW Sept. 3, p. 71). Istel has one of the only two Soviet parachutes this side of the Iron Curtain and has made 12 jumps with it, carefully studying its performance.

Sleeves & Gores

Two devices used by the Soviets to spare their parachutists vertebra racking jars:

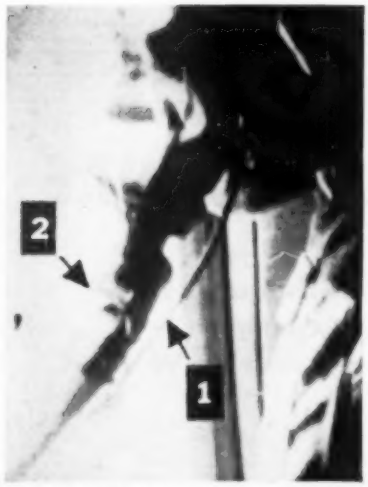
- **A sleeve** which straightens the jumper out before the canopy opens and prevents a sudden, snap opening. The main canopy does not have a pilot 'chute to pull the main 'chute taut against the jumper's weight.
- **A blank gore** which dampens out oscillation quickly and gives the 'chute some forward motion. This allows a jumper to land in an upright position rather than swinging into the ground at the end of an oscillating canopy. The forward motion gives the jumper a means of heading into any wind that might be blowing, thus cutting his speed relative to the ground by possibly 6-8 mph. The forward motion also imparts a certain lift to the canopy, according to Istel, slowing its rate of descent.

Istel thinks highly of the sleeve which, he says, does not exist on parachutes made in this country.

Here is how it works. The parachute's canopy is inserted into the sleeve in somewhat the same way a pillow is put into a pillow case. The sleeve is as long as the canopy. The shroud lines emerge from the open bottom of the sleeve, are laid straight up the outside of the sleeve a certain distance, then are criss-crossed back and forth across the sleeve back down to its opening. Here, the lines are used to secure a flap which closes the canopy inside. The lines secure the flap in such a way that a small tug on the lines releases the flap, allowing the parachute to be puled from the sleeve. The pilot 'chute is attached to the apex of the sleeve instead of the top of the canopy.

Pulling the Rip Cord

When the jumper pulls the rip cord, the pilot 'chute stretches the sleeve out to its full length, and the shroud lines also become straight as the jumper falls away from the sleeve. When all is taut, the weight of the jumper starts pulling the main canopy out of the sleeve against the drag of the pilot 'chute. It is this resistance to the



NEW YUGOSLAV palm parachute release (above) was used by that country at Moscow. Cable (1) runs under arm (2) to strong spring release in pack to aid sky dive technique.

INSTRUCTOR at the Centre National de Parachutism, Biscarrosse, France, G. Prik, demonstrates sky diving technique (above) at start of 1 min. free-fall jump. Precision of Czechoslovak jumper (below) is shown in a landing 3½ ft. from center of cross. Jump was from 1,950 ft. Note jumper pulling on lines to guide himself. Soviet jumpers used blank gore and sleeves to spare their parachutists vertebra racking jars.

Parachutes

falling jumper which straightens him out and aligns his body with the direction of fall before the canopy opens, thus eliminating the abrupt deceleration caused by a 'chute snapping open, which jerks a jumper violently into position.

As the canopy emerges from the sleeve, it opens gradually, avoiding the sudden popping open of a conventional parachute.

Istel cites these other advantages of the sleeve:

- **Line-over** (accidently getting a line over the top of the canopy which can result in serious tearing of the panels) is practically eliminated, as is the possibility of twisted lines.
- **Simplicity** of packing makes the sleeve very desirable.
- **Retrieving** the sleeve is easy because it is so big and therefore simple to spot.

Soviet 'Chute Pros & Cons

Istel calls the 'chute the Russian Blank Gore Parachute because a large portion of one of its 28 gores is missing, leaving a good-size, triangular opening in the rear of the 'chute's canopy.

Basis for his opinions are 12 jumps in the Soviet 'chute, plus some 80 jumps in various types of U. S.-made 'chutes, including several test jumps with the Pioneer Steerable Parachute. He listed these pros and cons:

Pros:

The Soviet 'chute will turn faster than American 'chutes. It will make

AN OPEN LETTER TO ENGINEERS WHO ARE THINKING OF THE FUTURE

Whether You're a Stress Analyst, Mechanisms Man, EE, or a Physics Major — Whatever Your Past Experience — There's a Place for You in Atomic Energy — at B&W

Take stock of yourself . . . your job . . . your living conditions. If you're boxed-in mentally; if your future looks dim; if you're living somewhere west of nowhere, or in a crowded city — or an outlying suburb — now is your chance to get out. Get in atomic energy. Live in Lynchburg—right in the heart of Virginia's beautiful Blue Ridge country.

There's plenty of elbow room right now in atomic energy at B&W. There's plenty of room to grow, as so many of our engineers have discovered. We think this is the place and the field you should consider, if—like most engineers—you're thinking about your future.

HERE IS A NEW FRONTIER—for you with B&W. And you don't need specific nuclear experience to take advantage of the opportunities. For example, if you have training and experience in any of the following categories, you can fruitfully apply your talents at B&W. There's a job waiting.

Stress Analysis

Vibration Analysis	**Systems Analysis**
Thermodynamics	**Servo-Mechanisms**
Heat Transfer	**Electronics**
Hydraulics	**Mechanisms Engineering**

Machine or Mechanisms Design:
Design, Layout, Checking and Drafting

THERE'S AN EXTRA PLUS, TOO. Fine living conditions in a clean city with excellent schools—and the friendliest sort of people for neighbors.

B&W has an engineering research and development background that spans nearly 100 years. We've been engaged with atomic energy problems from the beginning, at Oak Ridge, Los Alamos and Hanford. Today we're busy with a variety of atomic energy projects, from designing and building the first privately owned nuclear power plant, to pioneering in research reactors at home and abroad, to a feasibility study of a pressurized-water reactor for a nuclear-propelled cargo vessel.

B&W Nuclear Energy Plant located in Lynchburg, Va. — in the heart of the beautiful Blue Ridge country of Virginia.

Atomic energy is only in its infancy. But the AEC estimates that by 1970 at least 10 per cent of all new power will be generated by nuclear reactors. The men who are going to design and build these plants are getting their training today. It is a field of great growth during the next decade—a field you can grow with as a B&W engineer.

Take a step to build your future today. If you're the type that likes to pitch into new and different problems, we have the job you're looking for. The Babcock & Wilcox Company, Atomic Energy Division, 161 East 42nd Street, New York 17, N. Y.

PE-13-AE

Write for literature describing some of the atomic energy activities now under way at B&W. Address: Mr. W. F. Porter, Atomic Energy Division, The Babcock & Wilcox Company, 161 East 42nd Street, New York 17, N. Y.

BABCOCK & WILCOX

B&W

ATOMIC ENERGY DIVISION

automatic fire control by Reeves

USS FORRESTAL has been aptly described by Secretary of the Navy Thomas as "... the biggest ship ever built, the most complicated ship ever built, the most powerful ship ever built."

An important factor contributing toward making the Forrestal "the most powerful ship ever built" is the dependably accurate Automatic Gun Fire Control system which guides the fire of its anti-aircraft guns. Designed and built by the Reeves Instrument Corporation in conjunction with the U. S. Navy Bureau of Ordnance, this equipment, service tested on the USS FORRESTAL, has since been installed on its sister ship, the USS SARATOGA.

Systems engineering is our business. Whether for guidance, radar, fire control, computers or servo-mechanisms, Reeves has the man-power and the facilities to originate designs and produce entire systems.

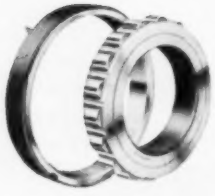
Reeves INSTRUMENT CORPORATION

REEVES INSTRUMENT CORPORATION
A Subsidiary of Dynamics Corporation of America
215 East 91st Street, New York 28, New York

16RV56A

WHO builds more jet engine roller bearings than anybody else?

HYATT does!



Another GM contribution to aviation progress

WHY?

1 HYATT HAS THE KNOW-HOW—We've engineered and produced far more jet engine roller bearings than any other supplier—so we've accumulated more experience.

2 HYATT HAS AN OPEN MIND—We're used to working hand-in-hand with aircraft engineers, seeking new and unorthodox ways to break "bearing barriers."

3 HYATT HAS THE FACILITIES—We've got plenty of tooling to produce *what* and *when* we promise—even though both schedules and tolerances are tight!

To break "bearing barriers" in a hurry, call HYATT for help! **For size ranges and load ratings of HYATT Aircraft Bearings, request Catalog A-56 from Hyatt Bearings Division of General Motors, Harrison, N. J.**

Watch "WIDE WIDE WORLD" Sundays on NBC-TV

HYATT HY-ROLL BEARINGS FOR AIRCRAFT INDUSTRY

Parachutist

Jacques Andre Istel, 27, has been parachute jumping for six years. In that time, he has made over 100 jumps. Two were static line jumps, all others were free falls. Of the 100, 45 were sky dives, the rest were jump-and-pull. Twelve jumps were in the Soviet 'chute. He also has acted as test jumper for Pioneer's Steerable Parachute.

Istel was captain of the U. S. jumping team which participated in the Third World Parachuting Championships held in Moscow last July. He won the National Spot Jumping Contest (the only parachute contest in the U. S.) held at Oklahoma City last September with a drop 34 ft. from the target.

Istel holds a class C International Parachutist rating and a commercial pilots license with instrument rating. He was born in France, is a naturalized American, and graduated from Princeton, class of '49. He served with the First Marine division in Korea and is a Captain in the Marine Corps Reserve.

Formerly with Air Associates, Teterboro, Istel has just formed Jacques Andre Istel & Co., a public relations firm concerned with parachuting in particular and aviation in general. Current address is Bedford, N. Y.

a 360 deg. turn in 3 seconds or less—about 20% faster than U. S. canopies.

Its forward speed, caused by the blank gore, is about 6-8 mph., although this is hard to judge because of the velocity of the air in which the 'chute is falling.

Opening shock is negligible—even at terminal velocity of about 125 mph.—because of the sleeve arrangement.

The missing gore (which is not a Russian innovation but has been tried out by the British and other nations for several years) virtually eliminates any tendency of the parachute to oscillate, making landing much easier.

The forward of motion of the canopy through the air actually creates sufficient lift to reduce the 'chute's rate of descent. Istel estimates that the Russian 'chute's sinking rate is approximately 14 ft./sec. compared to 18 ft./sec. of an average American canopy. Also, the forward motion allows the jumper to land into the wind, and reduce his ground speed by the 6-8 mph. forward speed of the 'chute.

Istel sums up the Soviet 'chute this way: "It eliminates the two principal drawbacks of parachuting—the shock of the canopy opening and the danger in landing . . . stand-up landings are not unusual with the Soviet 'chute."

Cons:

The Russian 'chute is bulky, primar-

Wickes

CONTROL TOWERS FOR EVERY NEED

FIXED • PORTABLE • EMERGENCY

New Wickes MS-15-B Tower
Overall Dimensions 6' x 6' - 7' high
Slanted windows reduce reflection

Light weight, durable, maintenance free construction of aluminum and fiberglass.

Controls and equipment custom assembled to meet any specific requirement from the Wickes line of standard control and communication components.

Consult us for your control tower requirements.

Wickes ENGINEERING AND CONSTRUCTION COMPANY
ESTABLISHED 1920
13TH STREET AND PERRY AVENUE — CAMDEN 4, NEW JERSEY

Senior PROJECT ENGINEERING Opportunities

At The Ramo-Wooldridge Corporation

R-W's systems engineering and technical direction responsibility for Atlas, Titan, and Thor—Air Force Intercontinental and Intermediate Range Ballistic Missiles—has created senior Project Engineering opportunities. These positions require liaison and planning with organizations throughout the United States associated with these weapons systems programs. Planning and coordinating responsibility includes airframe, guidance, nose cone, and propulsion. The project engineers participate in systems integration and in the formulation of research and development objectives.

Engineers whose backgrounds combine senior technical management responsibility with engineering experience in missile development are invited to explore these openings.

Please address inquiries to: Mr. William Coster

The Ramo-Wooldridge Corporation

5730 ARBOR VITAE STREET • LOS ANGELES 45, CALIFORNIA

ily because the shroud lines are about twice the diameter of those used on U. S. 'chutes. Also the hardware is bulky and obsolete, making the whole pack considerably heavier than American packs.

Workmanship, such as sewing, is poor. Placement of the rip cord housing is awkward and it is possible for the cord itself to kink. Also, the rip cord is difficult to reach when two 'chutes are worn.

Bulk of the Soviet pack is such that it disturbs the air flow around the jumper's body during free falls and an oscillating type of instability is induced.

The 'chute's forward speed cannot be reduced appreciably by pulling on the risers, making it difficult to hit targets during precision jumping contests.

Nevertheless, Istel considers the Soviet model "a very forgiving parachute."

Sky Diving

Istel, who is now actively engaged in encouraging the sport of parachuting in this country, is probably the foremost U. S. proponent of sky diving which he defines this way: "Sky diving is the art of maintaining absolute control of one's body during a free fall before opening the parachute. The sky diver must hold a stable bearing and, like a high diver, he must hold his arms, legs and back in certain, formal and prescribed positions. He must fall face down and with his body approximately parallel to the earth. Arms are outstretched and legs apart. He must be able to perform certain figures such as the figure eight. Spinning, somersaulting, or rolling with one's back to the earth washes out any points the jumper might have earned during that jump."

Istel is trying to establish, in cooperation with the proper government agencies, formal rules and regulations to govern the sport of parachuting, much as it is done in many European countries. One example is that all amateur jumpers would be required to make their first 15 jumps using a static line before they would be permitted to jump and open the 'chute with a rip cord. Also, free fall jumpers would be required to pull their rip cords at altitudes no lower than 1,500 ft.

Istel is convinced that, by using such devices as the sleeve to reduce opening shock and blank gores to soften the landing, Americans will take up parachuting as a weekend sport as the Europeans have done. He points out that in France there are more than 1,000 students training at ten parachuting centers under competent instructors. The French government pays the instructors and furnishes aircraft and equipment to give the students concrete assistance.

As Istel puts it, "With proper education and encouragement, the American public should take to the sport of parachuting as readily as they do to motor cycling—except that parachuting is much safer and less expensive."

Russian Blank Gore Parachute

The Russian Blank Gore Parachute is 28 ft. in diameter. It is made up of 28 gores with each gore 3 ft. 1¼ in. wide at the bottom. The blank gore ends 44 in. from the apex of the 'chute. A 6 in. wide cloth strip holds the canopy's skirt together at the base of the blank gore.

The canopy measures 13 ft. 10½ in. from vent to skirt. The vent is 22 in. in diameter.

Shroud lines are 22 ft. 10 in. long.

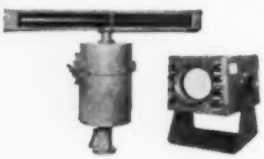
NEWS Edo NOTES

EDO AND ELECTRONICS

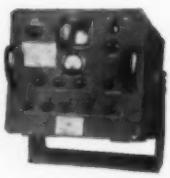
It may surprise you to know that Edo, recognized as the world's principal manufacturer of seaplane floats, is known in many circles mainly for its long string of achievements in the field of electronics.

In a broad diversification move which started 10 years ago, Edo has become a predominant factor in the field of sonar and underwater detection equipment, while continuing and expanding its role of hydrodynamic research which has seen, among other things, Edo's development of the hydro-ski and the first practical amphibious floats.

EDO DEPTH SOUNDER



EDO RADAR



EDO LORAN

In electronics, Edo has become a principal supplier to the United States Navy of deep depth sounders and greatly advanced sonar devices. Edo also markets a line of commercial electronic equipment, including the UQN, first depth sounder with a 6000-fathom range; the Edo Fishscope, an amazing fish-finding device; the Edo Radar of extreme accuracy and definition, and the Edo Loran, a compact, greatly simplified, direct-reading navigation instrument.

All these products, and many others, carry the famed Edo flying fish emblem, known by experts in many fields as the mark of superiority in design, function and reliability.

Edo CORPORATION

Since 1925 COLLEGE POINT, NEW YORK

Air Conditioning Installed in Viscounts

Cabin and cockpit air conditioning equipment is being installed in Capital Airlines' entire fleet of turboprop Viscounts. The freon-type equipment is made by Carrier Corp. and is being

BENDIX SUPERMARKET FOR PRECISION SYNCHROS

If you're in the market for precision synchros, it will pay you to make sure it's the *Bendix* "market" you're in. There you'll get—

FAST DELIVERY: Because of our heavy volume—as the country's largest producer of synchros—we can offer immediate delivery of practically all synchro types.

MINIMUM COST: Again, because of our heavy volume, we can fill even small-quantity synchro orders at production prices.

ALL TYPES—PREMIUM PRECISION: We make just about any type of synchro you could want—all built to the exacting precision standards that long ago made Bendix the "buy-word" for synchros.

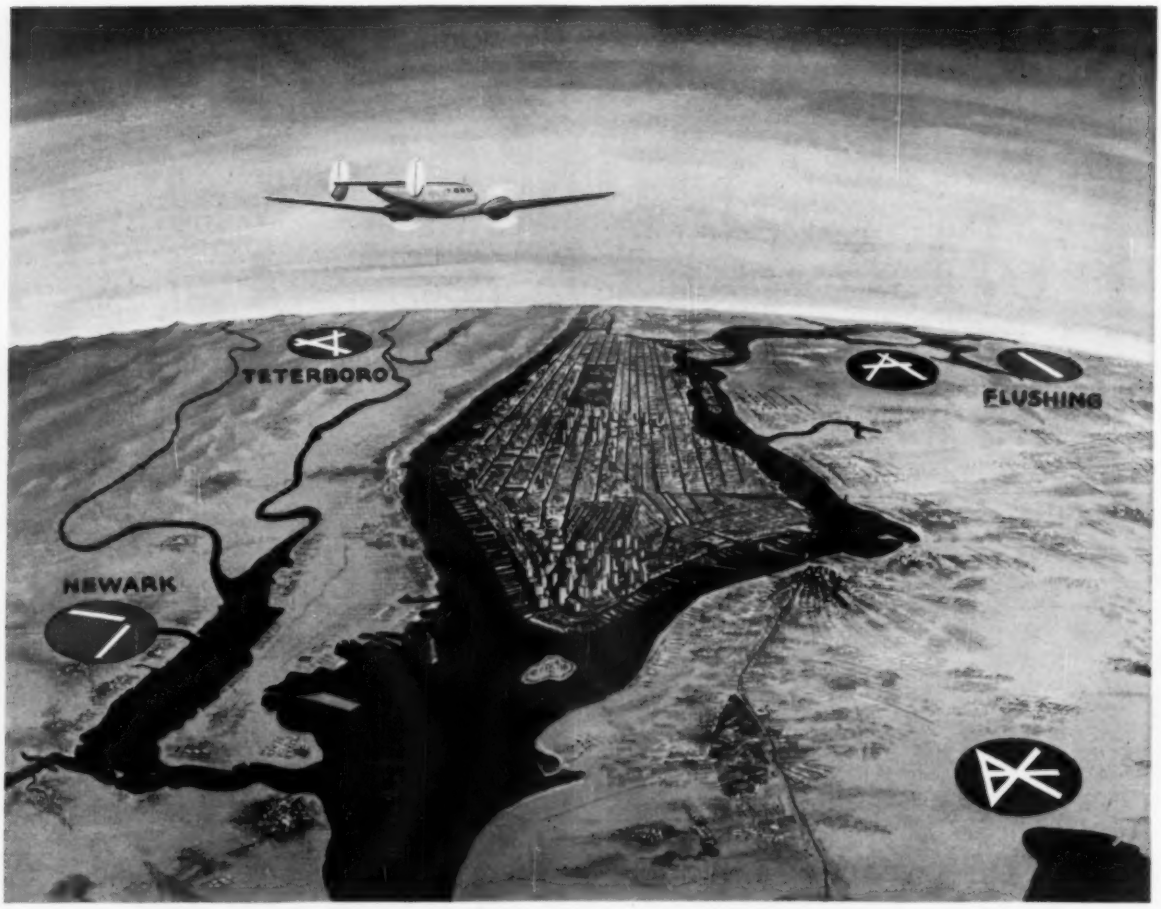
So, when you're shopping for precision synchros to use as transmitters, receivers, control transformers, differentials, or resolvers . . . including corrosion-resistant and high-temperature models . . . be sure to find out what we have to offer.

District Offices: Burbank, Calif.; Dayton, Ohio; Seattle, Wash.
Export Sales & Service: Bendix International Division, 205 E. 42nd St., New York 17, N. Y.

Eclipse-Pioneer Division

TETERBORO, N. J.

Bendix
AVIATION CORPORATION



AROUND THE NEW YORK SKYLINE...

It's always a short hop to

Esso

Flying over the skyscrapers of Manhattan you have a choice of Esso Dealer Airports where you can land for famous Esso Aviation Products, experienced operators and prompt service. A good choice, because high-quality Esso fuels and lubricants are used by the world's leading airlines and backed by over 46 years of careful flight testing and research.

What's more, *wherever* you fly from Maine to Texas, you'll find over 600 Esso Aviation Dealers ready to serve you. Private or company plane, business or pleasure, you'll also appreciate an Esso Credit Card for charging gasoline and oil, lubrication, tire and battery services, landing fees, over-night storage in transit and minor emergency repairs.

Wherever you fly — from Maine to Texas — look for quality, convenience, and service at the famous sign of the Esso Wings!

FREE TO PILOTS! *For your free Esso Flight Calculator, handy guide in figuring True Course, Drift Angle and Ground Speed, be sure to see your nearest Esso Aviation Dealer.*

installed in the planes as they arrive from Vickers in England.

The compact system, which has a capacity sufficient to air condition two average-size homes, will control both temperature and humidity in the Viscounts whether the plane is parked on the ramp, taxiing, or in flight.

The system's compressor is located under the forward cabin floor, condenser coils fit into the wings, and the evaporator is placed directly behind the galley.

The conditioned air is diffused throughout the cabin and cockpit from two overhead ducts furred into the plane's ceiling.

The entire system weighs 420 lb., costs an average of $6,200 and has a 4-ton refrigeration capacity.

Temperature reduction is about 20 deg. in 15 min. System is set to cycle at 60 deg. Maximum difference between cabin and outside air is 20 deg.

Hard Hat

New hard hat (above) for use with British equivalent of T-1 partial pressure suit replaces heavy mask and nylon hood (below). Transparent face-plate slams into place automatically when suit is pressurized and inflatable seal keeps pressure on exposed eyes. Inflatable pads apply pressure to head. Hinged mouthpiece permits in-flight feeding when suit is unpressurized.

New Leak Detector Developed by Boeing

A new way of chemically detecting leaks in aircraft fuel tanks has been developed by two chemists of Boeing Aircraft Co. It saves an estimated 75% in time and money.

In the new method bromocresol purple is sprayed or brushed on the outside of a fuel tank which is pressurized with ammonia gas. The bromocresol turns to a yellow, chalk-like powder when it dries. If the tank leaks, the yellow powder pinpoints the leak's location by turning purple.

When the testing is complete, the yellow powder may be removed easily with an air hose, water rinse or by wiping with a cloth. The harmless gas within the tank dissipates rapidly when released.

Advantages of the new method:

REVISED CATALOGUE of METAL HYDRAULIC CLOSURES for AIRCRAFT

Tubing Seal Cap, Inc. manufactures metal protective closures for handling, shipping and storage of aircraft hydraulic lines and assemblies.

Send for revised catalogue — new, larger sizes — **AN** specified items — economy prices of volume production — order and delivery information...

TUBING SEAL CAP, INC.
808 W. Santa Anita
San Gabriel, Calif.

Eastern Office:
428 New Center Bldg.
Detroit 2, Michigan

Your copy of the revised catalog will be sent in the next mail upon receipt of this coupon.

NAME _____
POSITION _____
COMPANY _____
STREET _____
CITY _____ STATE _____

Production Line Experience Proves the Consistency of New Sciaky Electronic Weld Control

First reports from aircraft industry manufacturers are unanimous in their recognition of the absolute weld consistency and positive reproducibility provided by the new Sciaky Predetermined Electronic Counter controlled welders.

Users say that, for the first time, it is now possible to get *precisely* what they set on the welder. The machine cannot deviate from its setting. It is consistent throughout the entire range of adjustment. And set-up to repeat previous production runs is simple and positive.

How It Works

Without deviation, the new Sciaky control counts the cycles of power line frequency which is governed by the U.S. Naval Observatory. In predetermined absolute numbers, cycles and impulses are simply counted by a Dekatron tube to control the duration of various welder functions.

Single Tube Handles All Succeeding Functions

A single tube is used to count both the respective cycles of succeeding functions as well as impulses of welding current. For example, only one Dekatron tube is used to count respective cycles of squeeze, weld, hold and off and in respective impulses, preheat, weld and postheat. A second Dekatron tube is needed only for simultaneous functions, such as cool, heat, and current decay.

All control dials for timing functions are calibrated in cycles, while all control dials for interval functions are calibrated in impulses of secondary current. No involved second-to-cycle calculations are required for welder set-up.

Simple Maintenance

Plug-in sub-assembly control units minimize maintenance down-time. Replacement of a sub-assembly is only a matter of minutes.

The absolute consistency of the control eliminates the need for time consuming periodical check-out or calibration.

Future applications of the machine that may require additional welder functions won't obsolete the welder. The plug-in sub-assembly feature permits easy addition of preheat, quench, postheat, etc.

Data Available

More complete information on operation and control combinations available with Sciaky Predetermined Electronic Counter controlled welders is given in Sciaky Bulletin No. 339. Copies are available on request.

At regular intervals Sciaky will present reports of jobs being done on Predetermined Electronic Counter controlled welders. Look for them in leading aviation industry magazines.

PMM 2 STK 125 KVA ROLL SPOT AND SEAM WELDER with Predetermined Electronic Counter Weld Control.

Largest Manufacturers of Resistance Welding Machines in the World

SCIAKY

Sciaky Bros., Inc., 4935 West 67th Street, Chicago 38, Ill., Portsmouth 7-5600

• **Cost of coating** the tank and filling it with gas (as little as 50 parts of gas to 1,000,000 parts of air) is small.
• **Application of the** coating and introduction of the gas is easy and quickly done.
• **Adaptability to** all enclosures allows the method to be used on a tank while still in its assembly jig, saving time.

Boeing has applied for patents for the method and materials used.

OFF THE LINE

New lubricant, specially developed for main and tail rotor helicopter bearing assemblies, has been put on the market by Shell Oil Co. The new grease, which is recommended by Sikorsky Aircraft for all its helicopters, minimizes fretting corrosion and prevents moisture corrosion, according to Shell. It flows well at temperatures down to −65F and will permit longer periods between lubrication.

A sales agreement has been concluded between Solar Aircraft Co. and Nissho Co., Ltd. of Tokyo, under which the Japanese firm will sell such Solar products as Sola-Flex bellows and expansion joints, welding fluxes and aircraft and engine components. Several other Solar developments including its gas turbine engines, are not yet included under the agreement. Other than Japan, Nissho will represent Solar in Formosa, the Philippine Islands, Hong Kong, Thailand, Indonesia and South Korea.

Pressure-sensitive cementable Teflon tape has been put on the market in a large variety of thicknesses, ranging from .0005-.060 in., and widths from ¼-12 in. The tape is bondable to aluminum, plastics, steel, glass and almost any other material. It is non-toxic. Address: Enflo Corp., Route 38 at Airport Circle, Pennsauken, N. J.

A filled epoxy resin, Epocast 11-C, has been developed to arrest harmful nuclear reactor radiation. Its high density mass will arrest alpha and beta radiation and offer resistance to gamma radiation, depending on thickness, according to the manufacturer, Furane Plastics, Inc. The plastic may be cast in complicated shapes such as shields around valve bodies, pipe fittings and other forms found in nuclear powerplants. Address: 4516 Brazil St., Los Angeles 39, Calif.

American Airlines has placed a $120,000 order for 125 ignition analyzers with Scintilla division, Bendix Aviation Corp. American will equip its entire fleet of DC-6s and DC-7s now flying and those to be delivered in the future. The 25-lb. instrument will be used either as an airborne or as a portable-airborne unit. In addition, American has ordered enough synchronizing breakers for the instruments to install one permanently on each engine of its DC-6 and DC-7 fleet. The analyzers, which will be mounted in the radio rack, feature rugged, 5-in. cathode ray tubes, sealed transformers, selenium rectifiers and edge-lighted front panels for easy control reading.

New primers which greatly improve the adhesion of vinyl dispersion coatings to metal and glass were announced recently by Bakelite Co. The division of Union Carbide and Carbon Corp. said the new primers stick with such adhesion that flat metal sheets may be coated with plastisol or organosol systems, then stamped or formed without rupture of the finish. Normally, coating flat sheets is much less expensive than coating formed shapes.

The E. W. Bliss Company has leased the Woodbine, N. J., Municipal Airport as a facility to test its runway overrun barriers and aircraft arresting gear. The company's Launching and Recovery Equipment division, whose offices are at the Philadelphia Interna-

delavan
NOZZLES
Delavan . . . designer and manufacturer of fuel nozzles for Pratt & Whitney Aircraft's J57 turbojet, powering the McDonnell F-101 Voodoo. Delavan has brought unprecedented nozzle performance to the aircraft industry.
DELAVAN Mfg. Co.
WEST DES MOINES, IOWA

'did he say 2 Avnets?'

YES! AVNET, WESTERN SALES, where orders are filled from a giant warehouse right on the premises; where your requirements are anticipated; where quality is controlled and reliability is guaranteed. In Aviation and Electronics, wide-awake buyers buy Avnet . . . West or East.

YES! AVNET, EASTERN SALES, where orders are filled from a giant warehouse right on the premises; where your requirements are anticipated; where quality is controlled and reliability is guaranteed. In Aviation and Electronics, wide-awake buyers buy Avnet . . . East or West.

Avnet | *8966 National Blvd., Los Angeles 34, Cal. TExas 0-7950; VErmont 7-1461 (Avnet Corporation)*

36 N. Moore St., New York 13, N. Y. BEekman 3-5780 (Avnet Electronic Supply Co., Inc.)

Bendix Connectors, Bendix Special Purpose Tubes, Sprague Capacitors and Condensors, Westinghouse Bulbs and Tubes, Thordarson Transformers, UG Connectors, JAN Switches and Circuit Breakers, Coaxial Cable, Fuses, JAN Resistors and Potentiometers, Cannon Connectors, Amphenol Connectors, Jones Plugs, Sockets, Strips. **WHAT A TERRIFIC SOURCE OF SUPPLY! Write Dept. R for catalogs on the above and other products and for information on how AVNET delivers on time.**

RESIDENT GOVERNMENT SOURCE INSPECTION ON THE PREMISES

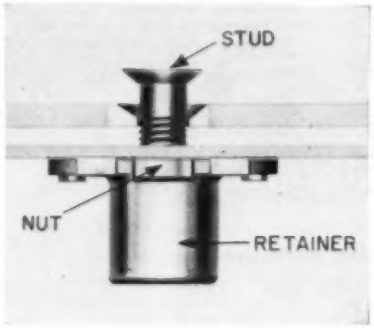
tional Airport, will install a catapult to accelerate test vehicles and dummy aircraft to the high speeds needed to simulate actual emergency stops by the firm's arresting gear and barrier systems. Bliss says it is developing the equipment for both military and commercial airports. The Woodbine airport has three 3,300 ft., concrete runways. Bliss is a major supplier of Navy steam-powered catapults and arresting used on aircraft carriers.

Allied Instrument Manufacturing Corp.'s name has been changed to Aviation Instrument Manufacturing Corp. The company, which has offices at the Houston International Airport develops, manufactures and distributes instruments and does custom manufacturing for the aviation industry. No change in company policy or management will result from the name change.

Automation Industries, Inc., designers and builders of specialized automation systems for a wide variety of industrial applications, has been acquired by Flight Refueling, Inc. of Baltimore, specialists in aerial refueling system design and manufacture.

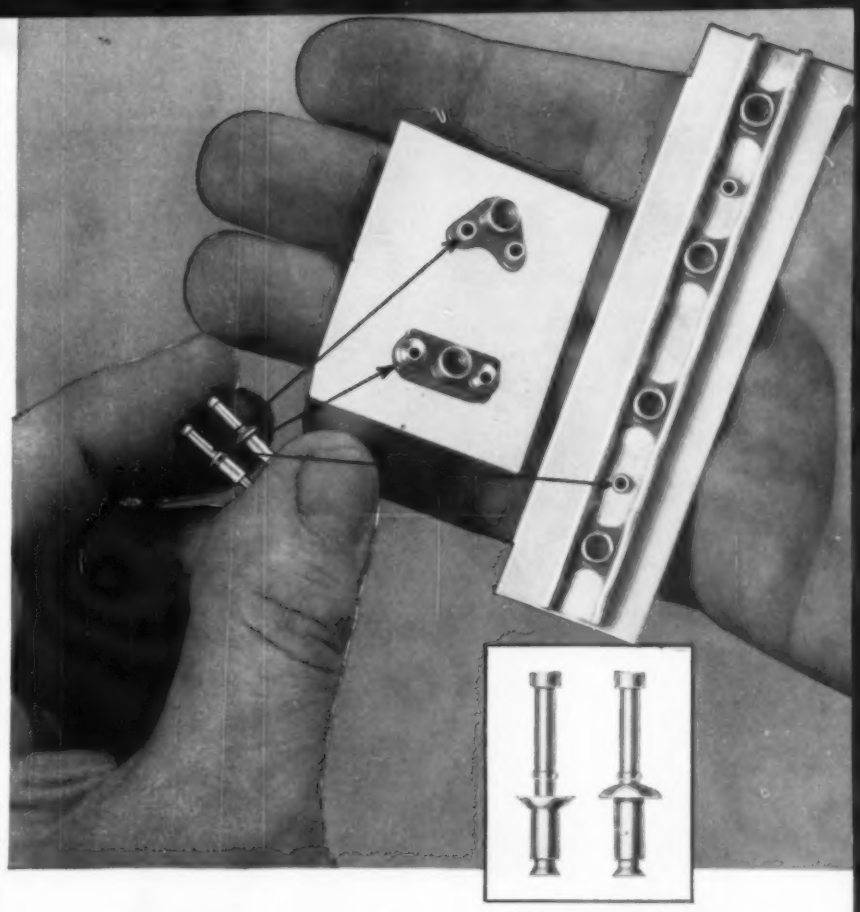
Collet Grip hydraulic tube fittings division of the Logansport Machine Co. has been purchased by Mayfair Industries, Inc., Chicago 18. The fittings, which heretofore have been available only in steel, now also will be made of stainless steel and aluminum.

Mayfair Industries produces special precision parts, forgings and fittings for the aircraft industry.



Fastener

Quick-operating, stressed-panel fastener is adaptable to curved panels of relatively small radius. Pastushin Industries, Inc., Los Angeles, the manufacturer, claims the fastener's ability to transmit full shear in bearing is equivalent to NAS 334 or 335 type bolts. Other quick-operating stressed-panel fasteners are Camloc Fastener Corp.'s SPF (AW Sept. 13, '54, p. 63) and Zahodiakin's high-strength fastener (AW Sept. 17, p. 61).



For those "Impossible" Installations

Cherry Research offers

the **3/32" MONEL**

HOLLOW PULL-THRU RIVET

Available with either universal or 100° countersunk head, the Cherry 3/32" Monel Hollow Pull-Thru Rivet has a high shear strength particularly adapted to fastening nut plates, gang channel and honeycomb materials where extremely limited space makes use of solid rivets difficult. Damage to surrounding material in these difficult spots is eliminated with the pull-thru hollow rivet. Simplicity and speed of installation cut costs and save weight.

The new 3/32" Monel Hollow Pull-Thru Cherry Rivet can be installed with all existing Cherry Rivet guns, including the G-25 Hand Gun.

For technical information write to Townsend Company, Cherry Rivet Division, P. O. Box 2157-N, Santa Ana, Calif.

CHERRY RIVET DIVISION

SANTA ANA, CALIFORNIA

Townsend Company

ESTABLISHED 1816 • NEW BRIGHTON, PA.

In Canada: *Parmenter & Bulloch Manufacturing Company, Ltd., Gananoque, Ontario*

Dr. S. W. Herwald, Univ. of Pittsburgh Manager, Air Arm Division

Dr. Ernst J. Schubert, Univ. of Vienna Fellow Engineer, Advanced Development

Dr. Peter A. Castruccio, Univ. of Genoa Advisory Engineer, Missile Sub-Systems Project System Section

Dr. James A. Stoops, Univ. of Indiana Senior Engineer, Development Engineering Analytical Section

Dr. R. F. J. Filipowsky, Technical U. of Vienna Advisory Engineer, Communications Engineering

Dr. Yaohan Chu, M.I.T. Supervisory Engineer, Fixed Fire Control Projects System Analysis Section

Dr. Arthur Kahn, Univ. of Indiana Engineering Psychologist, Analytical Section Development Engineering

They Accepted An UNPARALLELED CHALLENGE!

Reuben Lee, B.S.E.E., West Virginia Univ. Advisory Engineer in the field of transformers

Dr. L. G. F. Jones, M.I.T. Advisory Engineer, Development Engineering 132 A Project

Dr. M. Lauriente, Johns Hopkins Univ. Fellow Engineer, Components Engineering, Materials & Standards Section

Dr. Robert E. Horn, Washington University Senior Engineer, Development Engineering Analytical Section

Dr. Andrew W. McCourt, Univ. of Pittsburgh Section Manager, Development Engineering 132 A Project

Dr. K. N. Satyendra, Ill. Inst. of Technology, Fellow Engineer, Development Engineering Analytical Section

Leang P. Yeh, M.S., Harvard Univ. Fellow Engineer, Communications Engineering

Dr. Werner Rueggeberg, Johns Hopkins Univ. Fellow Engineer, Radar Equipment Engineering

Dr. George Marsaglia, Ohio State Univ. Senior Engineer, Development Engineering Analytical Section

WESTINGHOUSE-BALTIMORE is an engineer's company. Its phenomenal growth has been a direct result of the company's ability to attract the best engineering talent in the field—and to hold that talent with projects that offer an unparalleled challenge to their creative skills.

The men shown here are characteristic of the outstanding engineers and scientists who have contributed to the company's growth in the past . . . and who are pioneering its future growth into new dimensions where the only boundaries are the resources of the human mind.

There's room on this team for engineers who recognize the rewards which such a challenging concept brings.

WESTINGHOUSE-BALTIMORE

Learn More About These Opportunities

Write to Dr. J. A. Medwin, Dept. 510

Westinghouse Electric Corporation • P. O. Box 746, Baltimore 3, Maryland

Antenna wave propagation studies for new designs are made from models like this.

The sky is not the limit for engineers

Advanced programs of research and development are continually going on at North American's Columbus Division—programs that stimulate the imagination. Microwave, radome, antenna, flight control, fire control, servo-mechanisms and many more such projects are under intensive study. The men engaged are opening up entirely new areas in their professional fields.

This is a particularly favorable time for *you* to join this rapidly growing Engineering Department. Facilities include 16 completely equipped laboratories. A new air-conditioned engineering building will soon be completed.

The Columbus Division has prime responsibility for all North American's aircraft projects for the Navy—from concept through flight. Fine career opportunities for good men are available now. You should investigate immediately.

OPPORTUNITIES IN EVERY FIELD:

Aerodynamicists, Thermodynamicists, Dynamicists, Stress Engineers, Structural Test Engineers, Flight Test Engineers, Mechanical and Structural Designers, Electrical and Electronic Engineers, Wind Tunnel Model Designers and Builders, Power Plant Engineers, Research and Development Engineers, Weight Engineers.

Now is the time to act. Write: Mr. J. H. Papin, Personnel Manager, Dept. 56AW, North American's Columbus Division, Columbus 16, Ohio.

THE COLUMBUS DIVISION OF

NORTH AMERICAN AVIATION, INC.

The only **TEFLON® hose**

with years of flight service

...and a patented tube

TEFLON HOSE is the most reliable type of flexible line for continuous operating temperatures of −65° F to +450° F and for corrosive fluids . . . even nitric acid.

The patented compound of Teflon used in Fluoroflex®-T hose makes it unique. This compound imparts high tensile and tear strength . . . assures a leakproof seal at the coupling . . . provides thin wall tubing with proper flex life. With Fluoroflex-T hose, you're sure of high integrity, aircraft quality lines.

Resistoflex is the first and leading hose assembly manufacturer extruding its own Teflon tubing and having full control of tube quality and entire hose assembly. Over 4 years successful flight service stand back of this *original* Teflon hose. Send for details.

RESISTOFLEX CORPORATION, Roseland, N.J. Western Plant: Burbank, Calif.

® DuPont trade mark. • ® Resistoflex trade mark.

20th year of service to industry

Resistoflex

Aviation Week Check Ride:

Cessna 172 Pilot Needs Minimum Skill

By Richard Sweeney

Long Beach, Calif.—Base of Cessna Aircraft Company's line of business airplanes is the Model 172, a small, light, stable airplane which well suits the company's sales slogan—"Take a drive in the sky."

Selling for about $8,750, the Model 172 has been introduced with a new 1957 decor featuring a new type of paint trim and interiors.

A generator warning light has replaced the ammeter, but in flight characteristics, engine power and most other respects the 1957 model remains much the same as the 1956.

In demonstration flights, prospects are put in the left-hand seat of the 172 and put through a selling program which includes flying instruction. On takeoff, the demonstrator-pilot talks confidently while following through unobtrusively on the controls.

The tricycle landing gear low center of gravity for the 172, gives stability and a tendency to follow a straight line on the runway. This is an aid to the business man pilot and contributes much toward making the aircraft an ideal first plane. Once the airplane is airborne, the nose wheel does not turn when rudders are activated, reducing drag.

Landing characteristics are excellent without use of the flaps, which have four settings, 10, 20, 30, and 40 deg.

NEW MODEL 172 varies little externally from 1956 version; big change is improved interior.

Here again, the first flight pilot gets an impression of ease in operating the aircraft, as he is talked through his first landing.

In performance the 172 is not intended to be flashy, its dependability and ruggedness are stressed.

Specifications

The engine is the Continental O-300-A developing 145 hp. for takeoff at 2,700 rpm. Basic airplane empty weight is 1,288 lb., maximum gross weight 2,200 lb. Empty weight of the airplane evaluated, N7010A, a demonstrator belonging to Larry Hunt's Air Oasis Co., Long Beach, was 1,319 lb. Equipment includes LTRA-6 radio with omnimeter, plus the standard equipment included in the basic airplane. Evaluation weight of the airplane was 1,450 lb. with an outside air temperature 75F.

Standard takeoff was effected in less than specified distance under the conditions prevailing. Climb to 5,000 ft. took 7 min., using 2,550 rpm. and best climb speed of 78 IAS.

In a point-to-point flight at 5,000 ft., the airplane made a true air speed of slightly more than 100 mph., using 2,200 rpm, with an indicated airspeed of 94 IAS, approximating low power cruise. At the standard cruise power setting of 2,450 rpm, a true air speed of approximately 112 mph. was made on another point-to-point flight. In each case, outside air temperature was about 5 deg. above standard.

In maximum performance, the aircraft was taken off with flaps set at 20 deg., full power applied and the brakes released when maximum rpm. was reached. Ground roll approximated 400 ft., with a lift-off effected in tail low attitude at 45 IAS. Climb to traffic altitude was made at maximum continuous power, at the same flap setting, at a climb rate slightly better than 1,000 fpm.

In maximum performance landing, the aircraft was flown to the normal landing spot over the runway at an altitude of 400 ft. Power was cut, full flaps applied and back pressure trimmed out. The aircraft was on the ground and roll stopped without ex-

TRICYCLE LANDING GEAR, large flaps are major features used to sell 172's ease of handling.

A DIRECT CHALLENGE

TO THE PRODUCTION DESIGN ENGINEER

The Design Engineer at Rohr is engaged primarily in the tremendous field of power packages and power plant components, plus related structural design . . . the translation of theoretical into production design with consideration for serviceability, function, materials, and integrity encompassing all engineering factors that enter into design of the complete aircraft itself.

Here's the direct challenge you seek — the personal reward you desire. Because here, at Rohr, engaged in the practical design of ready-to-install aircraft power packages, your association is direct to the manufacturing of the item. You actually see what your design produced.

And, of course, lovely Chula Vista, California, located on beautiful San Diego Bay, offers you and your family the wonderful, outdoor, semi-tropical living you've dreamed of.

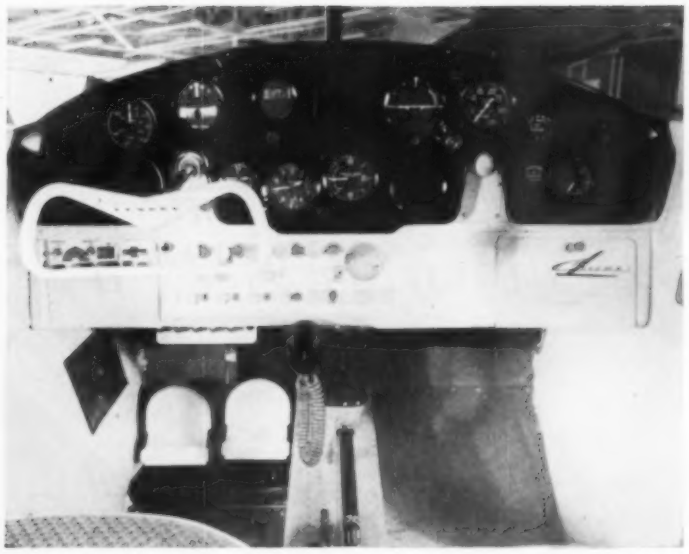
If you are experienced as a production design engineer, looking for the direct challenge and reward, and a better life, write Rohr now!

Please enclose full resume and we will answer at once. J. L. Hobel, Industrial Relations Manager, Rohr Aircraft Corporation, Chula Vista, California, Dept. 33A.

WORLD'S LARGEST PRODUCER OF READY-TO-INSTALL POWER PACKAGES FOR AIRPLANES

ROHR
AIRCRAFT CORPORATION

PLANTS IN CHULA VISTA AND RIVERSIDE, CALIFORNIA; WINDER, GEORGIA; AUBURN, WASHINGTON



NEW INTERIOR of 172 resembles latest trends in automobile styling, emphasizing Cessna's "Take a drive in the sky" sales campaign.

cessive brake, within 2,000 ft. from the landing spot, indicating the aircraft's leeway when brought in high over short runways or when landing over obstacles.

In slow flight for maximum fuel economy, the aircraft proved to have good handling characteristics at about 58 IAS at 4,000 ft., in the clean configuration. Power setting was 1,700 rpm. with mixture leaned as far as possible, with attention to smooth engine operation and temperatures.

In stalls, the airplane proves stable, possibly helped by the nose gear. In standard flight, including turns, the nose gear can be felt in comparison to the earlier Model 170, giving a rudder operation slightly different from that of conventional fixed gear airplanes.

Stall Recovery

In all stalls performed, straight and turns, power on and off, flaps at various settings, the airplane lost no altitude from start of the maneuvers at 6,700 ft. pressure altitude, until complete recovery was effected to safe flying speed. Recovery technique was nose to the horizon and application of power as necessary.

Panel layout of the airplane is good, with critical flight instruments in front of the pilot and engine gages to the right. Airspeed indicator is calibrated in both knots and miles. Provision is made for installation of basic IFR gyro instruments if the owner intends to use the aircraft for extensive night or instrument flying. Weight limitations preclude instrumentation and radio gear for complete all-weather flying operations, unless a single pilot and passenger are maximum load. Should all-weather operations be envisioned, a bigger airplane would be recommended, such as the Cessna model 182 or 130.

Structurally, the airplane has remained simple—two spar wing, semi-monocoque fuselage, single strut wing bracing, single leaf spring for the main landing gear. Controls are conventional in all respects.

In ground handling, the nose wheel is steered by rudder through 8 deg. each side of center. The nose wheel will free swivel through 30 deg. each way if short turns using brake are necessary. Wing and strut junction is the approximate pivot point for a free swivel and brake turn.

1957 Cessna 172 Specifications

Span	36 ft.
Length	25 ft.
Height	8 ft. 6 in.
Wing area	175 sq. ft.
Wing loading	12.6 lb./sq. ft.
Power loading	15.2 lb./hp.
Gross weight	2,200 lb.
Empty weight	1,260 lb.
Baggage	120 lb.
Fuel capacity	42 gal.
Top speed (sea level)	135 mph.
Max. recommended cruise @ 70% power @ 7,500 ft.	124 mph.
Range (at max. recommended cruise)	519 mi.
Max. range (at 97 TAS)	620 mi.
Powerplant	Continental O300-A @ 145 hp.

In taxiing, the airplane's excellent visibility can lead pilots to taxi faster than recommended. Cessna recommends minimum brake use to avoid excessive loads and wear on the brakes and nose gear. In high cross wind taxiing, the flight controls are used to keep maximum ground control.

Starting is conventional in the 172, as is stopping the engine using the mixture control. The gravity feed fuel system, simple and rugged, is operated through a four position control between the pilots' seats, either both tanks on, both off, or left or right tank individually used. Each tank contains 18.5 usable gallons of fuel.

Flap, Tab Controls

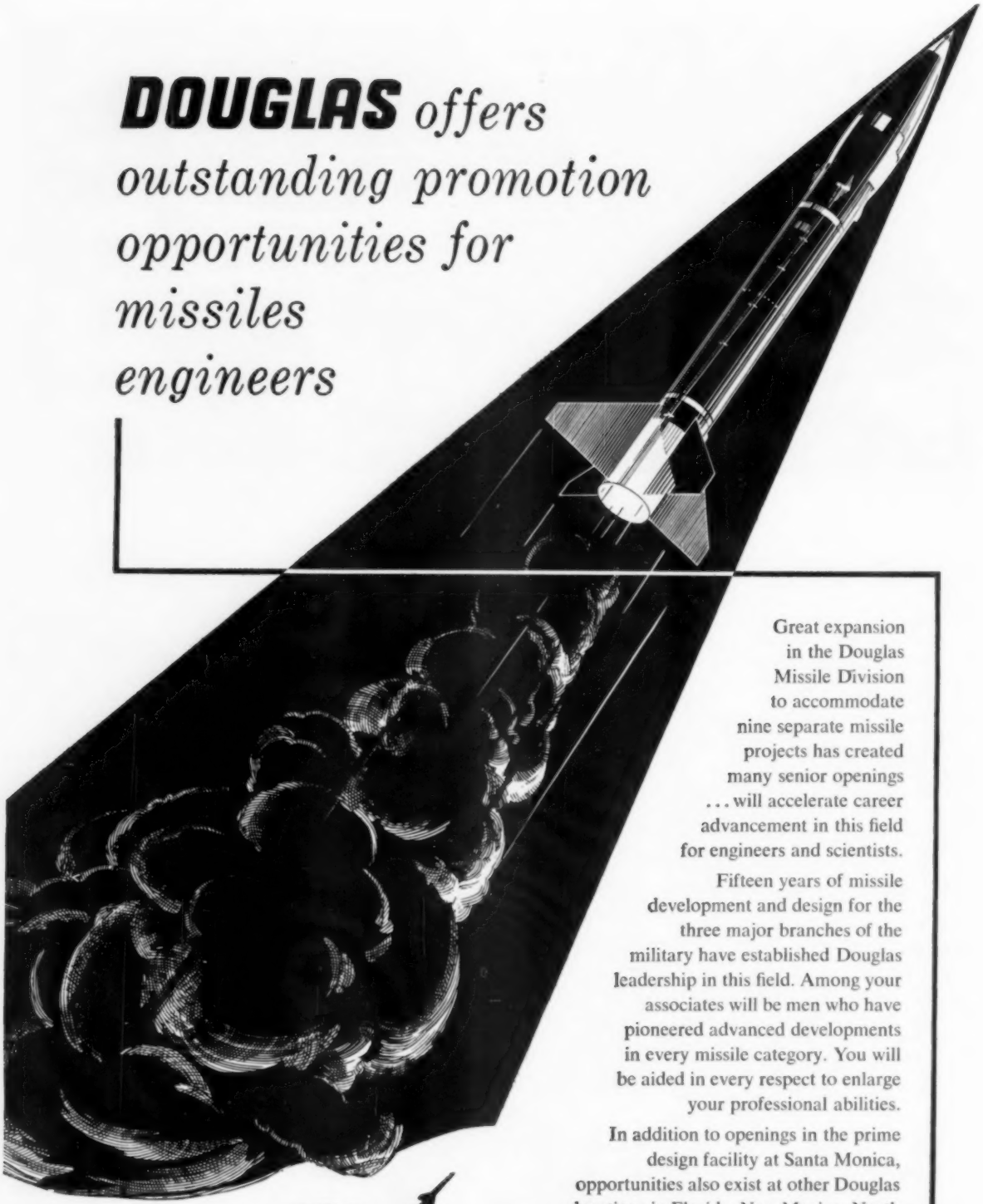
Other controls located between the pilots seats are the flap handle, which operates by notches with a thumb release button on the top, and the elevator trim tab, with a takeoff range marked in red. A rudder trim tab is provided, which is manually set on the ground for the desired cruising airspeed.

Two doors, each 36 in. wide, allow easy access. The airplane is easily converted for cargo carrying, and will take more than a quarter of a ton of cargo.

Two new interior color combinations are available in the 1957 model—Buckskin Tan or Capri Blue. Three color tones are available in each to make the carpeting, upholstery and trim in different shades of either tan or blue.

New exterior colors for 1957 are Mandarin Orange and Persian Maroon, with the old Cardinal Red and Strato Blue colors still available. All exteriors

DOUGLAS *offers outstanding promotion opportunities for missiles engineers*



Great expansion in the Douglas Missile Division to accommodate nine separate missile projects has created many senior openings . . . will accelerate career advancement in this field for engineers and scientists.

Fifteen years of missile development and design for the three major branches of the military have established Douglas leadership in this field. Among your associates will be men who have pioneered advanced developments in every missile category. You will be aided in every respect to enlarge your professional abilities.

In addition to openings in the prime design facility at Santa Monica, opportunities also exist at other Douglas locations in Florida, New Mexico, North Carolina and California.

For a personal interview, contact E. C. Kaliher, Missiles Engineering Personnel Manager, Box 620M Douglas Aircraft Company Santa Monica, California

MISSILES BY **DOUGLAS**

First in Aviation

Fairchild Operations Engineers, Plez P. Moody and Robert A. Booth study aspects of a carrier-on-board delivery plan involving the C-123 assault and logistics transport.

OPERATIONS ENGINEERS

The Operations Engineering Section of the Projects Administration Department of Fairchild Aircraft Division offers opportunities for graduate engineers capable of conducting aircraft utilization analysis.

These assignments require knowledge of and experience in:

- **Airworthiness Requirements**
- **Performance Analysis**
- **Power Plant Specifications**
- **Route and Mission Determination**

At the present time, these assignments relate to the Fairchild C-123 cargo transport, the Fairchild Friendship turboprop passenger transport, and the Fairchild M-185 jet utility transport.

The opportunities and salaries associated with the new positions are commensurate with the responsibilities of the work. Employee benefits in the form of group insurance, individual and family coverage for hospitalization, retirement plan, sick leave, etc., are also provided.

Send complete resume of education and experience,
together with salary requirements to:
EMPLOYMENT MANAGER – P.O. BOX 134

...WHERE THE FUTURE IS MEASURED IN LIGHT-YEARS!

FAIRCHILD

AIRCRAFT DIVISION • HAGERSTOWN 10, MARYLAND

A Division of Fairchild Engine and Airplane Corporation

aircraft turbine bearings...

DESIGNED for HIGH SPEEDS, LOADS and TEMPERATURES

New Departure split inner ring bearing mounting for jet engine main shaft

Today's leading production jet engines turn on New Departure split inner ring bearings . . . an out-ahead development of New Departure's continuing Aircraft Research Program.

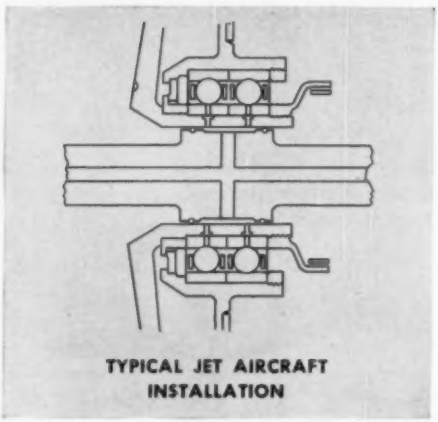
These turbine bearings handle heavy thrust loads from either direction and major radial loads with unexcelled dependability. Two-piece inner ring construction facilitates cleaning, inspection and assembly. It also permits use of the maximum number of balls of largest possible diameter with high thrust shoulders and one-piece separator construction.

While these bearings meet today's demand, tomorrow's needs command the facilities of the New Departure Aircraft Research Program. Already bearing development looks ahead to operational speeds in the order of 100,000 rpm and temperatures close to 1000° F. Write for New Departure's Aircraft Turbine Ball Bearing Folder TB-56. New Departure, Division of General Motors, Bristol, Connecticut.

MEDIUM and LARGE TURBINE BEARINGS

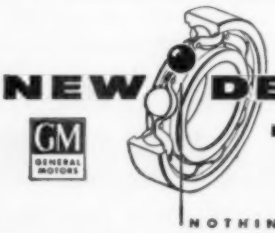
Basic Bearing No.	NOMINAL DIMENSIONS		
	Bore	O.D.	Width
LL34	6.6929	9.0551	1.102
LL36	7.0866	10.2362	1.614*
LL44	8.6614	12.5984	1.929*
L22	4.3307	7.0866	1.280*
L24	4.7244	7.4803	1.280*
L26	5.1181	7.8740	1.280*
L28	5.5118	8.6614	1.574*
L30	5.9055	8.5060	1.235*
L32	6.2992	9.4488	1.338
L34	6.6929	10.6299	1.815*
207	1.3780	2.8346	.669
209	1.7717	3.3465	.938*
212	2.3622	4.3307	.866
213	2.5591	4.7244	.905
214	2.7559	5.1181	1.023
215	2.9528	5.1181	1.181*
216	3.1496	5.5118	1.023
219	3.7402	6.6929	1.259
220	3.9353	7.0886	1.385*
222	4.3307	7.8740	1.771*
224	4.7244	8.4646	1.850*
228	5.5118	9.4488	2.007*
232	6.2992	10.1992	1.660
307	1.3780	3.1496	.826
315	2.9528	6.2992	1.456

*Puller groove, inner ring or both rings



TYPICAL JET AIRCRAFT INSTALLATION

SEE "WIDE WIDE WORLD" SUNDAYS—NBC-TV



NEW DEPARTURE
BALL BEARINGS

GM GENERAL MOTORS

NOTHING ROLLS LIKE A BALL

BALL BEARINGS MAKE GOOD PRODUCTS BETTER

have a common color striping of light cream.

According to Cessna figures, if the businessman flies 300 hr. annually in in Model 172, his cost per airplane mile amounts to less than 11 cents per mile. If he flies 500 hr. or about 62,000 mi. annually, this cost is reduced to less than 8 cents per mile. Cessna figures these costs to include gasoline, oil, maintenance, hangar charges, depreciation and insurance.

Cessna Sales Pitch Geared to Quantity

Long Beach, Calif.—Selling airplanes calls for merchandising techniques geared toward quantity sales. Introduction of new models is handled like the unveiling of a new automobile in the newly introduced Cessna system operated by distributors and dealers with factory cooperation.

Air Oasis Co., distributorship for Cessna in the Southern California area, premiered the 1957 Cessna Model 172 in a two-day showing. At the same time, other dealers and distributors scattered over the nation were doing the same thing in very much the same way, with aerial searchlights scanning the skies, newspaper classified and display advertising, static displays of airplanes and equipment in hangars, rides in the new airplanes, utilization of a small movie theater, and the employment of several pretty girls to aid in sales and general decor.

On the following weekend another Southern California dealer held the premiere of the same airplane, about 40 mi. from the Air Oasis showing. Air Oasis cooperated with this dealer in the second premiere, as the latter did with Air Oasis in its showing. Since the new models are scarce, both agencies pooled their supply for the static and flight showings.

In the static display a 172 was placed in an area curtained off by itself, with spotlights, refreshments, optional equipment displays. A Cessna film on business operations with the 172 and other Cessna aircraft was shown in a small theater adjacent to the 172 showing area.

In another section, a 310, 182 and several other lines of optional equipment for which Air Oasis is a dealer-distributor, were shown.

On the flight ramp, a new 172 and other Cessna airplanes were lined up for inspection by visitors as they streamed through the gate. Some 172s used in flight demonstrations were at the far end, adjacent to the taxi strip.

In preparing for the premiere, 500 invitations were mailed out, including group letters to civic clubs and other bodies. Display advertising was used in regional and local newspapers, along with clever classified teaser ads. A 15-min. telecast was set up between the showings at Air Oasis and the other dealer, sponsored by Air Oasis. Air Oasis owner Larry Hunt feels that whatever contributed to Cessna sales in his area contributed to overall business increases in the distributorship.

During the premiere, 341 persons registered, while another 200 were estimated to have attended without registering.

Of these, 134 were considered sales prospects, while 71 were considered hot enough sales potential to be put immediately under the aegis of the Air Oasis sales staff. Some 59 were ruled out completely, while card and contact analysis left 147 as less likely prospects which will be worked on by the sales staff at leisure.

All told, 212 rides were given in the four airplanes available for this purpose.

Doing the flying were Hunt salesmen and one saleswoman.

Westland Flies New Utility Helicopter

Westland Widgeon five-place utility helicopter seats three passengers side-by-side in the rear of the cabin and one next to the pilot. A winch is fitted on the starboard side for rescue and specialized cargo work. A clam-shell-type nose door aids stowage of ambulance litters. The Widgeon is basically an improved Sikorsky S-51 with an entirely new cabin and revised rotor hub. Performance data shows normal cruise true airspeed of 70 mph. at sea level at 5,900 lb. gross weight with fuel consumption of 22 gph. Best rate of climb at engine takeoff power (Alvis Leonides) is given as 970 fpm.

AVRO AIRCRAFT

offers opportunities for these people— with or without aeronautical experience:

Mathematicians • Computer Programmers • Aerodynamicists • Metallurgical Technicians • Stress Engineers • Systems Engineers • Mechanical Engineers • Flight Test Engineers • Controls Engineers • Aero Thermodynamicists • Vibration & Flutter Engineers • Civil Engineers for: Structural Analysis, tests, Design • Computing Specialists • Draftsmen & Technicians

Avro Aircraft's broad and diversified range of advanced aeronautical design projects gives engineering people unexcelled opportunities to utilize individual ingenuity, initiative, imagination and creative qualities.

All aspects of Engineering at Avro employ the most up-to-date scientific techniques and modern facilities. These are under the guidance of some of the world's finest engineering talent. As members of a progressive design team, more concentrated job responsibility means more recognition for individual ideas and accomplishments.

You who are interested in responsible work now, on design concepts which represent the most advanced state of your art, should

Write today to:

EMPLOYMENT MANAGER,
AVRO AIRCRAFT LIMITED,
BOX 4004, TERMINAL 'A',
TORONTO, CANADA

AVRO AIRCRAFT

Air Taxi Fleet Moves to Florida To Escape Winter Time Doldrums

Cleveland—To offset loss of revenues that approaching winter weather would impose on its Midwest-based air taxi fleet, TAG Airlines is developing a migratory pattern that involves shifting its fleet with the seasons.

Last April TAG Airlines formerly Taxi Air Group, inaugurated floatplane air taxi service between downtown Detroit and downtown Cleveland, starting with a six-passenger DH-Canada Beaver and an 11-passenger DH-Canada Otter. Operations have been so successful that TAG is getting another Otter.

However, winter operation of float planes along the Great Lakes area has been deemed impractical, and TAG was faced with "beaching" its fleet until flights could be resumed in the spring. Rather than remain tied down to such an unprofitable operation, TAG has sent its planes and crews to Florida, where it will commence a 16-flight-daily schedule seven days a week connecting with outgoing and incoming de luxe airline services at Miami International Airport. The company expects to return to the Midwest in May, when the tourist season slackens.

Initial Florida flight will connect the International Airport with North Key Largo and Marathon, the latter 100 mi. south and Boca Raton and Stuart, 100 mi. to the north.

TAG executives also contemplate developing service 100 mi. westward to Naples. Two of the three planes will be used on the regular scheduled service, the Beaver being held in reserve and for special charter services.

TAG will carry passengers and cargo. Fares to North Key Largo and Boca Raton the in-between stops, will be $9.95 plus tax; the longer hops to Marathon and Stuart will cost $15.95 plus tax. Passengers are allowed 40 lb. of baggage.

Normally, the trip by car down the Keys to North Key Largo takes about three hours; TAG can make the trip in 45 minutes.

Car travel to Marathon is estimated at four hours; the Otter will do it in about one hour.

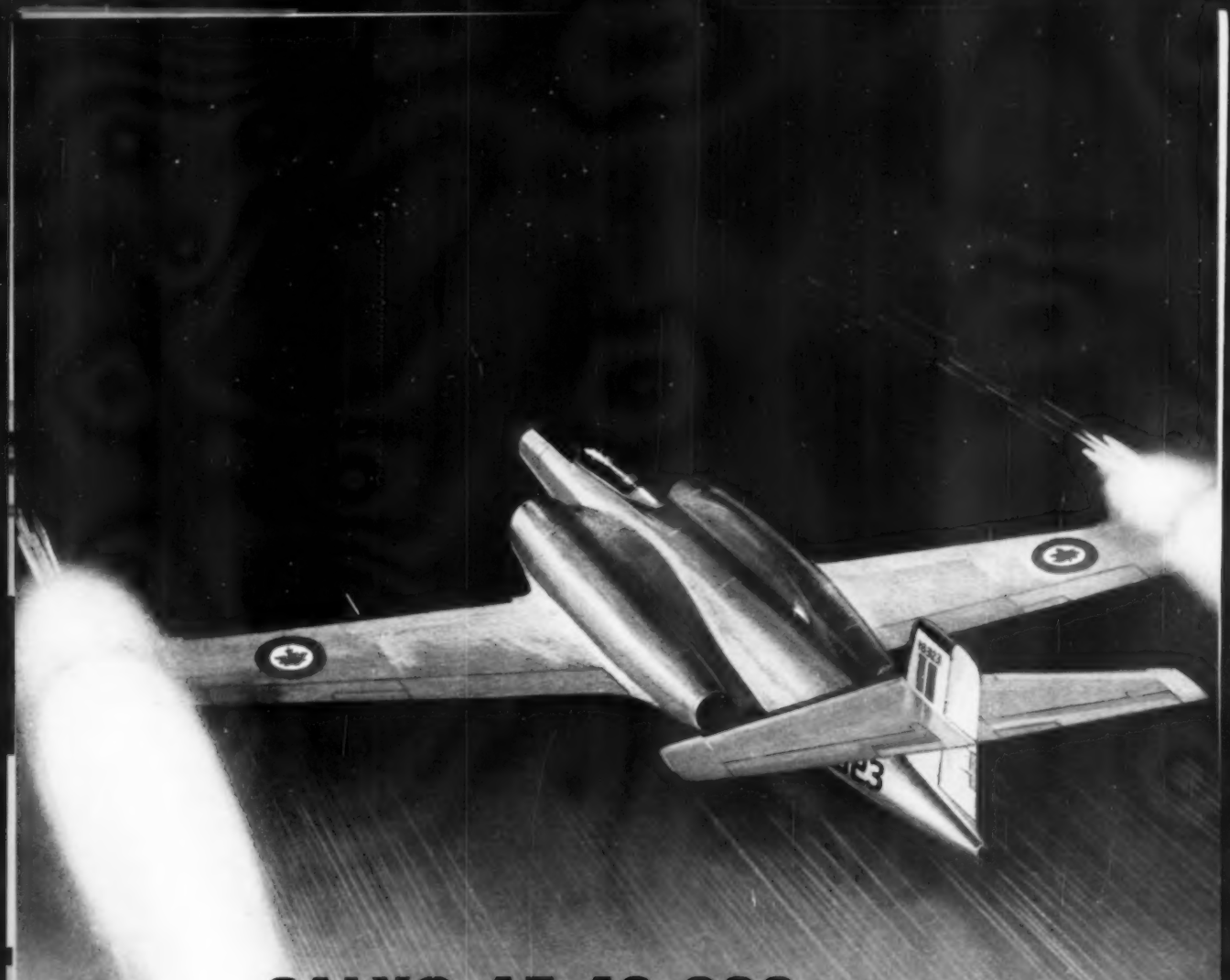
In the season recently concluded between downtown Detroit and downtown Cleveland, TAG Airlines carried 3,600 passengers and approximately three tons of freight in its two aircraft. The planes make the trip in less than an hour, less time than it takes to drive during the rush hours from the downtown area of either city to its suburbs.

Business executives, many of whom have offices in both cities, are among TAG's top customers. Also available to them is Cleveland Air Taxi Service's Bell helicopters, which operate to 35 points in and around Cleveland to the seaplane base.

During its initial season in this area, TAG made four flights daily between Detroit and Cleveland, Monday through Friday. The flight takes 50 minutes with the fare being $14 one way and $25 round trip. When the cities

Bell Ranger Lifts Six Persons

New Bell 47J Ranger four-place utility helicopter is shown lifting six people during a demonstration at Quayaquil, Ecuador to military personnel. Pilot Joe Mashman later flew to the farm of the President of Ecuador for a personal demonstration of the 47J.



SALVO AT 40,000

This split second in the RCAF's radar-controlled lead collision course attack technique demonstrates the most powerful weapon in air defence. Automatically released, a salvo of rockets from the Avro CF-100, packing the punch of a destroyer, *boxes the target in a lethal concentration of fire power.*

Interceptor squadrons of the RCAF being equipped with the Mk. 5 variant of the CF-100 . . . capable of operational performance at high altitude . . . practice rocket firing day and night, as part of their round-the-clock alert.

AVRO AIRCRAFT

AVRO AIRCRAFT LIMITED

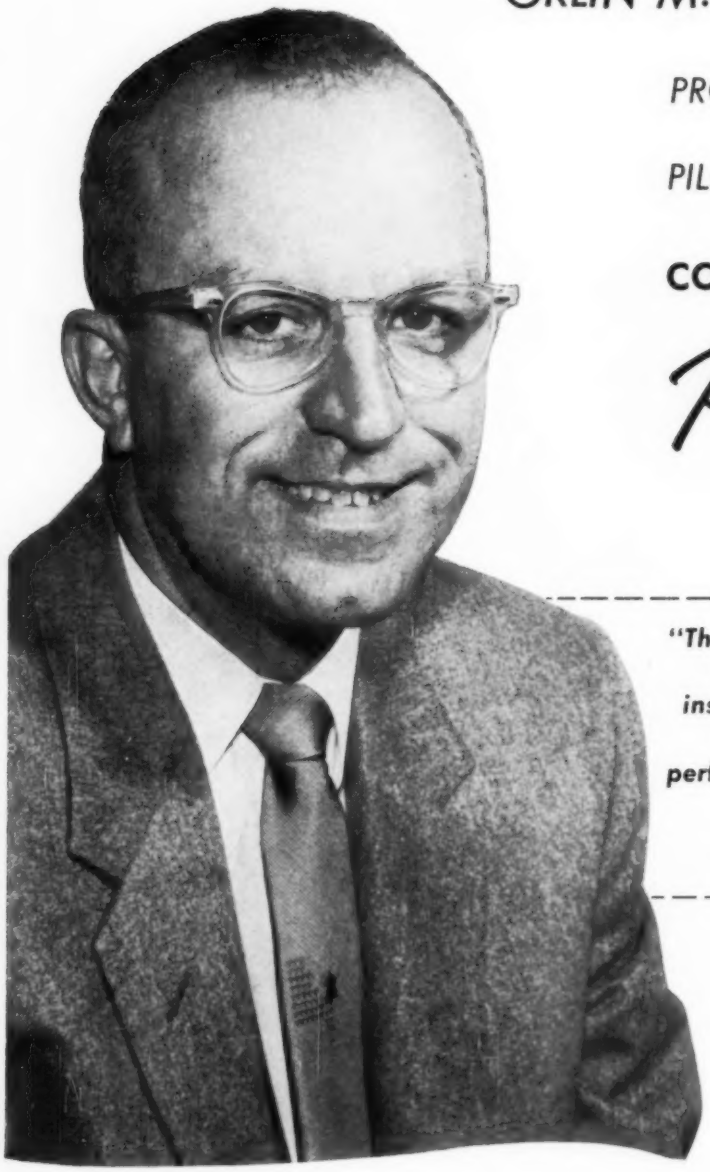
MALTON, CANADA

MEMBER: A. V. ROE CANADA LIMITED & THE HAWKER SIDDELEY GROUP

ORLIN M. SORENSEN,

PROMINENT WEST COAST PILOT, SALUTES

COMMANDER 680-SUPER *Performance*



"The greater speed of the Commander 680 saves us hours instead of minutes — while the higher altitude, single-engine performance is a great safety factor."

Orlin M. Sorensen

Orlin Sorensen, chief pilot for Signal Oil and Gas Company of Los Angeles, has a record of business, transport and military flying that pre-dates World War II. His globe-wide experiences qualify him for flying and directing the Signal air fleet to business appointments throughout the country.

AERO *Commander*

For complete information see your nearest Aero Commander distributor or write for Catalog 128-S

AERO DESIGN & ENGINEERING CO • TULAKES AIRPORT • P.O. BOX 118 • BETHANY, OKLAHOMA

returned to standard time, the number of daily flights was cut to three.

Executives of the air taxi float plane service expect to extend their flights to downtown Toledo and Ashtabula next year. They have also applied to the Canadian government for permission to operate charter flights across the border.

Narco Develops New Omnigator Version

Ft. Washington, Pa.—To meet private and business flyer requirements for increased number of communications channels at low cost, National Aeronautical Corp. (Narco) has developed a new 27-channel version of its Omnigator navigation-radio equipment.

The new Omnigator Mk. 2 replaces the previous eight-channel VTR-1 on the Narco production lines and will list at approximately $895 with three crystals installed, compared with the previous model's price of about $875. In addition to multi-channel VHF communication and VOR navigation, the Mk. 2 also provides ILS localizer guidance and 75-m.c. marker. Frequency range covers 118-123 m.c. Supplied as standard equipment are crystals for 122.1, 122.5 and 122.8 m.c.

Features of the Narco Omnigator Mk. 2 include:

• **Printed circuitry** and miniaturized crystals enabled Narco engineers to keep Omnigator Mk. 2 dimensions down to the size of the previous model and reduce weight. Total installed system weight of the new model is under 18 lb., compared with some 18½ lb. for the earlier version.

• **Transmitter power** of the Mk. 2 is four to five watts, double that of the previous model.

• **Band width** has been tripled to permit use of frequencies in the 118-123 m.c. range. Narco did this by broad-banding a single powerful transmitter circuit, retaining the simplicity and reliability of narrow-band systems.

• **Tuning is simplified** by making the vertical frequency pointer stationary and the tuning dial rotatable. This technique allows optimum lighting for the frequency numbers and provides a fixed "target" during tuning.

• **Improved VOR presentation** is provided by a new two-function indicator. Located in the upper left corner of the panel is the standard left-right blue-yellow meter for course presentation and a small window displaying "To-From" indication. Should a station being tuned be too far away, or altitude of the airplane be too low for satisfactory VOR navigation, a red alarm flag will appear in the window.

Vigorous Air Force Investigation Urged

Washington—Air Force has been asked to "pursue with vigor" investigation of a mid-air collision of a Lockheed T-33 jet trainer and a Cessna 170 private plane at Midland, Tex., Oct. 30. All seven occupants of the two planes were killed: both Air Force personnel in the T-33 and the pilot-owner of the 170, W. R. Clement, Bowie, Tex.; his wife and child, and Mrs. Clement's parents.

The Air Force is being asked to supply a copy of its report on investigation of the accident to Aircraft Owners & Pilots Assn., Washington, D. C. It would be "improper and unfair to prejudge the cause of this terrible accident," AOPA vice president Max Karant wrote USAF Secretary Donald A. Quarles. The letter called Secretary Quarles attention to what it calls a "most disturbing record" of military jets being involved in collisions and near-collisions.

The letter to Secretary Quarles, made public by AOPA, included these excerpts from four communications it states it received from its membership within a day of the Midland accident, citing experiences they have had involving military planes:

• **"Over Austin, Tex.,** on Oct. 24, while flying at 7,000 ft. on Victor Airway an Air Force jet came within 15 ft. of the top of our aircraft while apparently buzzing, causing loss of con-

Lightplane Imports

Melbourne—Re-examination of lightplane import license applications will be made by Australian trade authorities early next year. This is expected to result in some applications on file being processed. Australia has held up import of lightplanes for agricultural purposes because of unfavorable money balances in recent months.

When permits are issued, it is expected that preference will be given to import of aircraft types already used in Australia because of the availability of spares.

STEEL

Every Kind

Quick Delivery

Aircraft Quality Alloys and Stainless Steels also bars, structurals, plates, sheets, tubing.

RYERSON

Joseph T. Ryerson & Son, Inc. Plants: New York, Boston, Wallingford, Conn., Philadelphia, Charlotte, Detroit, Cincinnati, Cleveland, Pittsburgh, Buffalo, Milwaukee, Chicago, St. Louis, Seattle, Spokane, Los Angeles, San Francisco

Now!... the NEW

ROBINSON WIRE TWISTER

with DIAGONAL GRIP-HEAD

Faster, more efficient than ever! The new, slendernose DIAGONAL GRIP-HEAD is designed especially for those narrow- hard-to-reach places. Split-second whirling action safety-wires 3 engines in time required for one by any other method . . saves as much as $140 per engine assembled.

3-TOOLS-IN-1 . . pliers-cutters-twisters. Side-cutting, oil-tempered head. Permanent bronze bearing. No adjustments. Jaws lock on wire, can't slip off. Perfect, uniform twist every time.

12" —for assembly line safety wiring, 15 oz. **$21.50**

9" —for bench work, sub-assemblies, 12 oz. **$20.50**

Unconditional Money-Back Guarantee. Send for complete details.

RALPH C. ROBINSON CO.
Box 494W No. Sacramento 15, Calif.

Canadian Distributor, Gensales, Ltd., Malton, Ont.

One of these days
... you'll be living in
Southern California

If you're happy right where you are—if you like your job, your boss, your neighbor's children, the weather—then this message may be a little premature.

But if you sometimes suspect things could be better, then we'd like to tell you about the Southern California Cooperative Wind Tunnel, and about living in Pasadena.

We don't expect anybody to pull up stakes and move out here tomorrow. But if you're looking for more of the good things in life, both job-wise and otherwise, we think the CWT and Pasadena have a great deal to offer. No resume to send—just mail the coupon below for the CWT story.

CWT

Operated by the California Institute of Technology. Owned by Convair, Douglas, Lockheed, McDonnell and North American.

CWT is concerned with testing, analysing and solving aerodynamic problems involved in the development of high-speed aircraft and guided missiles.

Southern California Cooperative Wind Tunnel
950 South Raymond, Pasadena, California

GENTLEMEN: *Please send me literature about the Wind Tunnel.*

NAME_____

HOME ADDRESS_____

CITY_____ STATE_____

trol and possible structural damage," one business pilot wrote AOPA. "Although we have personally experienced similar situations several times recently this was the worst."

A check with Bergstrom AFB revealed that such complaints by private pilots and others were practically a daily occurrence, the pilot's letter stated.

• **"Flying south of Bergstrom AFB** at approximately 7,500 ft. in clear weather, a lone jet changed its altitude by several thousand feet and altered its heading by about 90 deg. in order to make a direct head-on pass at me," another letter to AOPA states. Another incident reported by the same pilot involved four jets. According to his letter, he was flying at about 2,500 ft. in a Cessna 172 when the jets approached from his right in fairly close formation. The 172 pilot wrote that he attempted evasive action, but the four jets separated and passed in front, behind, above and below him.

Other complaints reported Air Force aircraft flying at "wrong altitudes" requiring the civil planes to change course. The AOPA letter to Secretary Quarles also referred to a collision between a F-86 jet fighter and a light twin civil plane during a night interception near Albuquerque, N. M., June 28. The civilian aircraft, carrying six persons, landed safely.

PRIVATE LINES

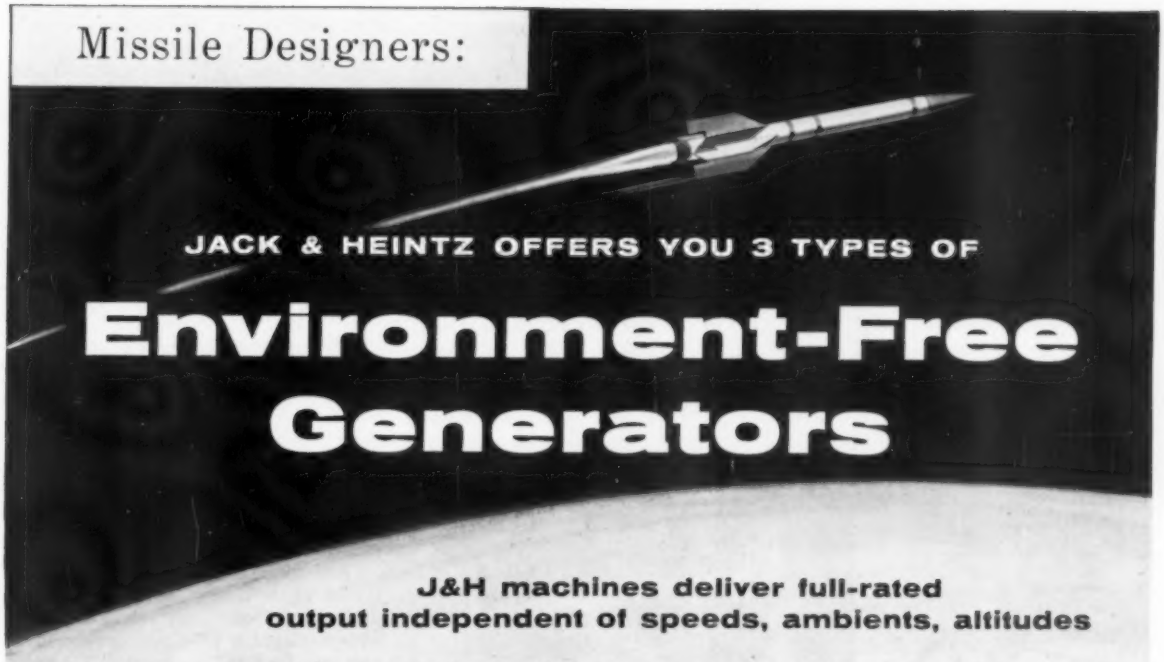
Tests of vari-colored wind-activated markers, strung on power lines around airports are being made by Washington State Aeronautics Commission at Stergion Field, Enumclaw. The plastic markers are expected not only to identify the hazard, but also facilitate depth perception. Units were provided through cooperation of Standard Oil Co.

Tri County Airways, Inc., White Plains, N. Y., received a license from Canadian Air Transport Board, Ottawa, to operate international charter service to points in Quebec and Ontario using aircraft having disposable loads of up to 6,000 lb.

Six DH Dove light transports will be delivered to the Iranian Oil Consortium beginning the end of this year, for transporting personnel between refinery and oil fields. IOC's Doves will be Series 5 models seating eight. Nearly 500 are in service.

First maintenance contract covering North American Sabre jet fighters to be awarded a private overhaul facility has been awarded Pacific Airmotive Corp., which will handle F-86As, Es and Fs

Missile Designers:



JACK & HEINTZ OFFERS YOU 3 TYPES OF

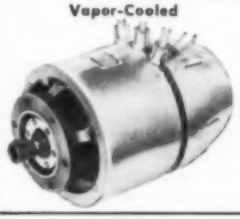
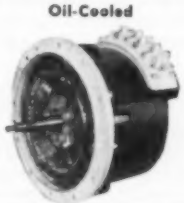
Environment-Free Generators

J&H machines deliver full-rated output independent of speeds, ambients, altitudes

In answer to the electric power needs of such weapons as North American's *Navaho* and Boeing's *Bomarc*, Jack & Heintz has successfully developed three approaches to the design of environment-free generators for missiles. With many completed units within each classification, J&H is in a position to meet quickly the requirements of missiles of all types: SSM SAM ASM AAM AUM UAM USM UUM.

Short-Duration Flights: J&H *thermal lag* generators are capable of delivering full-rated output throughout flight without benefit of cooling.

Long-Duration Flights: J&H *vapor-cooled* and *oil-cooled* generators using water and engine or hydraulic oil as coolants will deliver full-rated output regardless of speeds, ambients or altitudes.

Representative J&H Generator Designs for Missiles	Vapor-Cooled 	Oil-Cooled 	Thermal Lag
J&H Model	G188-5	31190-005	31186-001
Nominal Rating (kva)	30	40	10
Duty	continuous	continuous	intermittent
Volts	120	120/208	120/208
Speed (rpm)	12,000	6,000	12,000
Phase	3	3	3
Frequency (cps)	400	400	400
Power Factor (minimum)	.8	.75	.9
Weight (lb)	66	75	29.5
Length (in.)	13	9	10
Diameter (in.)	9	9.75	7

To Meet Your Specific Needs: J&H missile power specialists are available to confer on your specific requirements . . . generators and regulators. You may obtain basic engineering data on other J&H environment-free generators by writing to Jack & Heintz, Inc., 17635 Broadway, Cleveland 1, Ohio. Export Department: 13 East 40th Street, New York 16, New York.

© 1956 by Jack & Heintz, Inc.

JACK & HEINTZ AIRCRAFT ELECTRIC EQUIPMENT

Is your Jet Engine RPM Measurement Accurate???

The NEW B&H Instrument

TAKCAL

• • • Reads Jet Engine Speed to Guaranteed Accuracy of 10 RPM in 10,000 RPM (±0.1%)

Checks Tachometer System

Adapts to any Frequency Problem

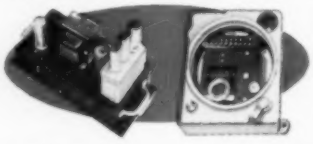
The inter-relation of RPM to efficiency and thrust in jet engines is fundamental. Proper adjustments for maximum thrust, engine life and safety of operation can be made only upon accuracy of instrumentation.

The new B&H TAKCAL incorporates a refinement of the frequency meter principle. It operates in the low (0 to 1000 cps) range, reading the frequency of the tachometer generator on a scale calibrated in percent RPM corresponding to the engine's RPM. In addition, the TAKCAL checks the tach system. The TAKCAL circuit and tachometer are parallel so that readings can be made simultaneously to determine the accuracy (or inaccuracy) of the aircraft's tach system. The TAKCAL operates during the engine run to properly set up engine controls for maximum economy and safety.

The TAKCAL's component parts are identical with those used in the J-Model JETCAL Analyzer. They are here assembled as a separate unit tester and for use with all earlier models of the JETCAL Tester.

The TAKCAL operates accurately in all ambient temperatures from −40°F. to 140°F. Low in cost for an instrument of such extreme accuracy, it is adaptable to application in many other fields.

Explosion-proof TAKCAL for special applications. Measures 200 to 7500 RPM, direct reading, with ±0.1% accuracy.



TAKCAL

For full information write or wire

West Coast Office: 427 E. Grand Ave., El Segundo, Cal.

B & H INSTRUMENT CO., INC.
3479 West Vickery Blvd., Fort Worth 7, Texas

at its Chino, Calif., base. Value of the letter contract is $750,000, although the final award is expected to total considerably more. PAC plans an increase of approximately 40% in personnel at its Chino Division to handle the new work. PAC and its subsidiary, Pacair, reported consolidated sales of $14,759,926 for the nine months ended Aug. 31, compared to sales of $14,230,118 in the same period last year. The company recently received an Air Force letter contract to overhaul 497 helicopter engines.

Italian Nardi F. N. 333 four-place single-engine amphibian has started its flight test program. The plane is designed to meet U.S. Civil Aeronautics Administration certification requirements and is scheduled to make a tour of the U.S. next year. Four are being produced under a cooperative program between Nardi and Fiat.

Over 600 of Federal Telephone & Radio Corp.'s new lightweight autopilots have been sold, comprising the company's entire 1956 production. Current production is about 100 units monthly. Price on the two-axis model remains $1,995; the three-axis unit is now $2,395. Units are currently CAA-certificated for Beech Bonanza C35 through G35, Cessna 180 and 310; in process are Cessna 172, 182 and Piper Apache. Installations are scheduled for Royal Gull and Aero Commander 560 and 680.

Auxiliary fuel installation for Beech D18s comprising a 50-gal. Heliarc welded aluminum tank in each wing is being developed by Chamberlain Aviation, Inc., Akron, Ohio. Tentative installed price: $3,000. Another Chamberlain D18s development is installation of wingtip extensions to improve aileron control at low speeds.

Douglas DC-3 loaded to 23,350 lb. made a series of approaches over a 50 ft. obstacle and came to a full stop on the runway within 800 ft. of the obstacle using Safe Flight Instrument Corp.'s speed control instrumentation.

Hi-fi 16 2/3 rpm. record installation has been fitted to a Cessna 182 by dealer Carl Ettinger, Santa Fe, N. M., for a customer. Basis of the installation is a Chrysler hi-fi set with custom audio-amplifier making it entirely separate from the plane's radio. Records play approximately 45 min. Front and rear cabin speakers give the sound a three-dimensional effect. Dealer Ettinger reports that because of widespread interest in the installation he has contacted Chrysler on the possibility of buying sets directly from the car maker.

New Missile Submarine

Artist's conception of nuclear-propelled guided missile submarine requested as a part of Navy's 1957 construction program. Sub is designed to launch and provide short range control of guided missiles and be capable of self-defense by means of conventional armament. Data available: Length 346 ft., beam 29 ft.

USAF Contracts

Following is a list of unclassified contracts for $25,000 and over as released by Air Force Contracting Offices:

GENTILE AIR FORCE STATION, Dayton 10, Ohio, Dayton Air Force Base.

Collins Radio Co., Cedar Rapids, Iowa, modification kits for AN/ARC-27 contractor's P/N 540-9986-00 (PR 642891) spare parts, 33097 ea, $149389.

Bruno New York Ind. Corp., 460 W. 34th St., New York 1, N. Y., multimeter AN/USM-33 engrg data and maintenance data (RFP 33-604-56-2853), 265 ea, $49668.

Empire Devices Products Corp., 38-15 Bell Boulevard, Bayside 61, N. Y., meter, noise and field, Empire Devices Products Corp. model NF-105 (RFP 33-604-56-3679), 15 ea, data for above item, $62400.

Bendix Radio, Div. of Bendix Aviation Corp., E. oppa Road, Towson 4, Md., 10 items of clips, reactors, oven and switch assys, transformers, coils, modulators (call 56-6), various quantities, $149337.

Continental Electronics Ltd., 302 Oakland Street, Brooklyn 22, N. Y., relay motor driven nonpile up type continental electronics P/N 3555, 200 ea, relays motor driven pile up type, continental elect P/N 3615, 200 ea, relays motor driven pile up type continental elect P/N 2115, 200 ea, relay motor driven pile up type continental elect P/N 4555, 200 ea, (RFP 33-604-56-2657), $46558.

Continental Electronics Ltd., 302 Oakland St., Brooklyn 22, N. Y., relay, motor driven, SPST Continental Electronics P/N 2575, 200 ea, relays, motor driven, SPST Continental Electronics P/N 5585, 200 ea, relays-time delay 3PST Continental Electronics P/N 7125, 200 ea, relay, motor driven, nonpile up type, SPST Continental Electronics LDT P/N 3675, 200 ea, relays, motor driven, non-pile up type, SPST Continental Electronics LTD P/N 3915, 400 ea, (RFP 33-604-56-3226), $52460.

The Garrett Corp., Airesearch Mfg. Co. Div., 9851 Sepulveda Blvd., Los Angeles, Cal., 4 items of filters, suppressors and thermostats (call 56-4), var quantities, $34409.

United Mfg. Co. Div., The W. L. Maxson Corp., 41 Haig St., Hamden 14, Conn., tester assy, port load bank type A-1 in a/w spec MIL-L-4709 dtd 10 Sept 53 and amend 1, dtd 22 Nov 54 engrg data and handbook data (RFP 33-604-56-3619), 35 ea, $96087.

Guardite Corp., 9335 S. Cottage Grove Ave., Chicago 28, Ill., cabinet, instrument testing altitude and temperature in a/w USAF spec MIL-C-8353A (ASG) dtd 4 Oct 54 and Exhibit "A" att engrg data, maintenance data (IFB 33-604-56-173), 13 ea, $99658.

General Electric Co., Electronics Div., French Rd., Utica, N. Y., modification of AN/ALT-6 and associated equipment (PR MD-658-167), 500 ea, $2850810.

The General Tire & Rubber Co., 1708 Englewood Ave., Akron 9, Ohio, test set electrical cable AN/UPM-16, rev. handbook data, engrg data in a/w table 250 tt (PR 675669), 41 ea, $61500.

Taffet Radio & Television Company, 27-01 Brooklyn Owens Expressway, Woodside 77, N. Y., audio oscillators, TS-382 D/U in a/w Spec MIL-A-4291A dtd 28 Dec 54, engrg data, maintenance handbook data (PRF 33-604-56-1569), 2157 ea, $467583.

AMC, WRIGHT-PATTERSON AIR FORCE BASE, Ohio.

Bendix Aviation Corporation, Eclipse-Pioneer Division, Teterboro, N. J., type PB-20 automatic pilot for MTU (C-133A aircraft), (PR (PE) 709780), $28686.

Motorola Incorporated, 2710 North Clybourn Avenue, Chicago, Ill., antenna, A8-360/APS-23, 148 ea comparator CM-24/APS-27, 91 ea. 709802-1, 709815-1, $1411385.

American Machine and Foundry Company Division, The Leland Electric Company, Dayton, Ohio, motor generator, 250 VA, 329 ea (PR PE-635606), $115498.

General Electric Company, French Road, Utica, N.Y., indicator, azimuth for APG 41-B radar, (PR WR-407608), $160284.

Bendix Aviation Corp., Eclipse-Pioneer Division, Teterboro, N.J., spare parts, MT&TE and data, (PR PE-709769 and 709769-1), $1459809.

Pesco Products Div., Borg-Warner Corp., 24700 N. Miles Road, Bedford, Ohio, motor assemblies, P/N 4234-220094-021-02, 73 ea, motor assemblies, P/N 5234-220060-010-01, 57 ea, motor assemblies, P.N. 4234-220068-023-03, 143 ea, motor assemblies, P/N 4234-220064-040-02, 21 ea. (PR's SA-535225, SA-535228, SA-535291, SA-535292, $48255.

General Electric Co., Erie, Pa., generators, aircraft engine driven, 30 volt, DC, 300 amp, type R-4, 215 ea, flanges for generator, 334 ea. generators, aircraft engine driven, type AN3633, 197 ea. (PR PE-735656 and PE-735658), $391267.

Bendix Aviation Corp., Red Bank Div., Eatontown, N.J., generators, engine driven, 115 volts, AC, 8 KVA, type C-3, Bendix P/N 1634-7-C, (PR PE-635651), 903 ea, $391769.

Thomas A. Edison, Inc., West Orange, N. J., transmitter, pressure, type MH-3, 506 ea. indicator, pressure, type MO-2, 824 ea. (PR 670685), $180051.

Robertson Photo-Mechanix Inc., 7440 West Lawrence Ave., Chicago 31, Ill., camera, copying (MIPR R56-178-23375 G/6 1/ASQ), 39 ea, $37596.

Bendix Aviation Corp., Pioneer-Central Div., Davenport, Iowa, transmitter, rate of fuel flow, type J-4 (PR 635968), 619 ea, $135102.

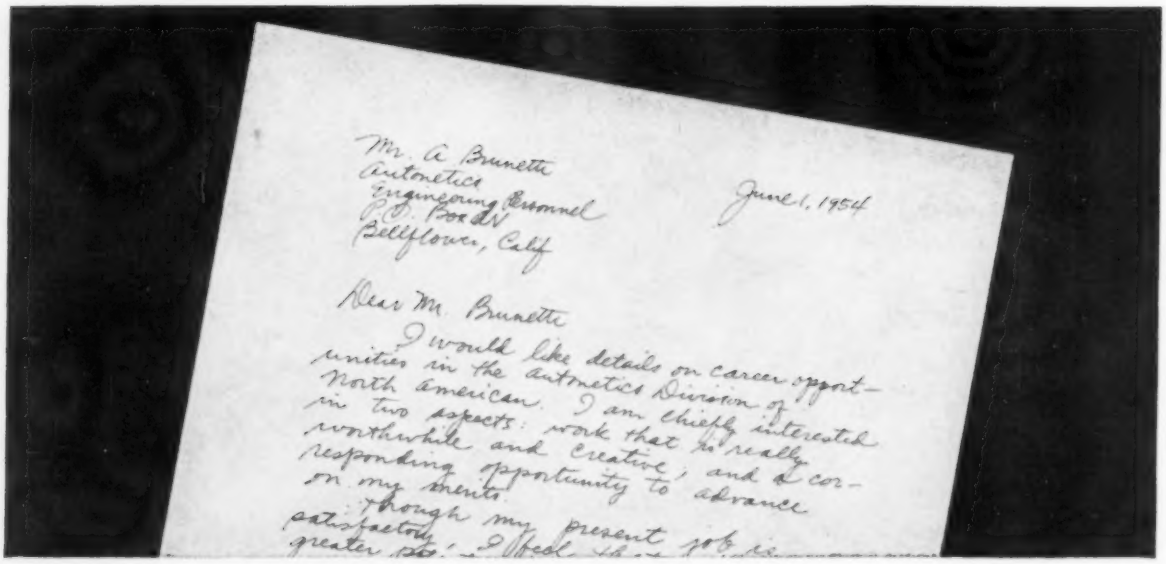
General Dynamics, Convair Div., Ft. Worth, Tex., decontamination facility for B-36 aircraft, (PR 671039), $38000.

General Dynamics Corp., Convair Div., AF Plant No. 4, Ft. Worth, Tex., additional facilities in support of B-58 program (PR 701106), $3526000.

Lockheed Aircraft Corp., Marietta, Ga., additional facilities in support of C-130 aircraft production, (PR 669669), $90645.

Hughes Aircraft Co., Culver City, Cal., design, construction of taxiway, acquisition and erection of prefabricated steel building, and acquisition and installation of supporting machinery and equipment, (PR 669559), job, $171025.

Studebaker-Packard Corp., Detroit, Mich., acquisition, installation and rehabilitation


Mr. A Brunetti
Autonetics
Engineering Personnel
P.O. Box 4W
Bellflower, Calif
June 1, 1954
Dear Mr. Brunetti
I would like details on career opportunities in the Autonetics Division of North American. I am chiefly interested in two aspects: work that is really worthwhile and creative, and a corresponding opportunity to advance on my merits.
Though my present job is satisfactory, I feel

This letter moved a man ahead 5 years

Two years ago a man took 10 minutes to write this letter. Today he enjoys the responsibility and professional standing in the AUTONETICS Division of North American that might have taken 7 to 10 years to achieve in other fields.

THE FIELD AT AUTONETICS—A FIELD OF OPPORTUNITY

Now under way at AUTONETICS are nearly 100 projects, comprising some of the most advanced and progressive work being done today in the fields of Electronics, Electro-Mechanics, Control Engineering and Data Processing.

You will work on automatic control systems of many kinds, for manned and unmanned vehicles. Every state of the art is represented, from preliminary conception right through flight testing. Facilities are the finest obtainable. Your colleagues will be men of ability and imagination, of the highest professional standing.

The long-range potential in this field is truly limitless. The techniques being developed at AUTONETICS today will have the widest application in the industrial methods of tomorrow.

You owe it to yourself to consider how far you can advance by entering this exceptionally promising field right now. Here are the opportunities:

COMPUTER SPECIALISTS • COMPUTER APPLICATION ENGINEERS • ELECTRO-MECHANICAL DESIGNERS • ENVIRONMENTAL TEST ENGINEERS • ELECTRONIC COMPONENT EVALUATORS • INSTRUMENTATION ENGINEERS • FIRE CONTROL SYSTEMS ENGINEERS • FLIGHT CONTROL SYSTEMS ENGINEERS • ELECTRONIC RESEARCH SPECIALISTS • AUTOMATIC CONTROLS ENGINEERS • ELECTRONIC ENGINEERING WRITERS • INERTIAL INSTRUMENT DEVELOPMENT ENGINEERS • PRELIMINARY ANALYSIS AND DESIGN ENGINEERS • RELIABILITY SPECIALIST

Write your letter today. Decide now to get the facts, so you can make the most of your potential. Just put your address and brief qualifications on paper—handwritten will be fine. Reply will be prompt, factual, confidential.

Write: Mr. A. Brunetti, Autonetics Engineering Personnel, Dept. 991-11 IRE, P. O. Box 4W, Bellflower, California

Autonetics
A DIVISION OF NORTH AMERICAN AVIATION, INC.

AUTOMATIC CONTROLS MAN HAS NEVER BUILT BEFORE

of machinery and equipment (PR 708719), job, $1422355.

Boeing Airplane Co., Seattle, Wash., facilities for Air Force Plant No. 13, (PR 669554), job, $231000.

Boeing Airplane Co., Wichita, Kans., facilities for the production of B-52 aircraft, (PR 180789), $4400000.

International Business Machines Corp., Poughkeepsie, N.Y., facilities for the logistic support of AN/FSQ-7 combat information centrals (PR 180794), $100000.

General Electric Co., Johnson City, N.Y., facilities for the testing of MD-4 and MD-1A armament systems for B-47 and B-66 aircraft, (PR 636500), $30000.

Solar Aircraft Co., San Diego, Cal., acquisition, installation and rehabilitation of machinery and eqpt. (PR 708720), $246000.

Kelsey-Hayes Wheel Co., Detroit 32, Mich., acquisition, installation and rehabilitation of machinery and eqpt. and laboratory and testing equipment for the production of J-57 engine components, (PR 636496), $854000.

I. T. E. Circuit Breaker Co., Philadelphia, Pa., Machinery and equipment, (708718), $89573.

American Welding and Mfg. Co., Warren, Ohio, facilities for the production of J-57 engine components, (PR 636-410), $99000.

Hayes Aircraft Corp., Birmingham, Ala., facilities for DoD Plant Nr. 1, (PR 669605), $85000.

General Dynamics Corp., Convair Div., Ft. Worth, Tex., facilities in support of WS-125-A program, (PR 565095), $7500000.

McDonnell Aircraft Corp., Lambert Field, St. Louis, Mo., repair of model 96 store, preparation of qualified personnel information, and engineering changes for F-101A aircraft, (PR's PA-226889 and PA212042), $1509367.

Fairchild Engine and Airplane Corp., Fairchild Acft. Div., Hagerstown, Md., addition of new item 16, prototype installation of ECP-801 & CCN's R-166, R-170 and R-169 for C-119G aircraft, (PR PH 205059), $36712.

Ex-Cell-O Corp., Lima, Ohio, facilities for the production of J-57 engine components, (PR 701108), $1785600.

Gilfillan Bros., Inc., 1815 Venice Blvd., Los Angeles 6, Cal., installation, calibration and non-personal services for AN/GPN-T2 trainer, (PH 635545), $31072.

Oneida Limited, Oneida, N.Y., acquisition, manufacture, installation of machinery and equipment, (PR 708712), $175400.

American Bosch Arma Corp., Arma Div., Garden City, N.Y., facilities in support of the WS-107A program, (PR 701105), $710000.

ACF Industries, Inc., Erco Div., Riverdale, Md., special tools and test equipment, (PR PH-671790), $26602.

General Dynamics Corp., Convair Div., San Diego, Cal., facilities in support of the WS-107A program, (PR's 565098, 565097, 565099 and 565100), $7815000.

United Aircraft Corp., Sikorsky Acft. Div., Bridgeport 1, Conn., H-19D helicopters, technical data for H-19 aircraft, (MIPR R-56-601-TC), $5164092.

Lockheed Aircraft Corp., Marietta, Ga., facilities in support of the WS-125A program, (PR 701103), $4000000.

AVCO Mfg. Corp., Advance Development Div., Stratford, Conn., facilities in support of SW-107A, (PR 565102), $1075000.

Douglas Aircraft Co., Inc., Santa Monica, Cal., facilities in support of the WS-315A program, (PR 670554), $2026000.

General Electric Co., Syracuse, N. Y., facilities in support of the WS-107A program, program, (PR 670551), $308000.

The Rand Corp., 1700 Main St., Santa Monica, Cal., facilities for training of personnel, programming and development of the AN/FSQ-7 combat direction central, (PR ADMIS-56LP-38), $950000.

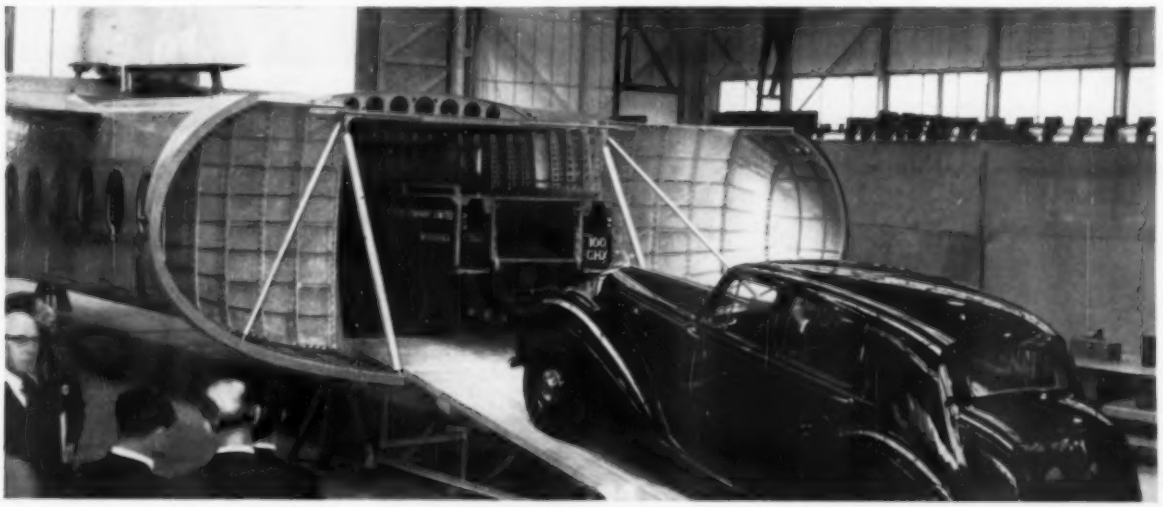
Consolidated Diesel Electric Corp., Ludlow and Canal Sts., Stamford, Conn., multi-purpose servicing vehicle, type MA-2, 442 ea. winterization kit for multi-purpose servicing vehicle, 442 ea. engineering data, lot, (PR 173658-1-2-3, PR 509721-1-2 and PR 537701), $6615690.

General Electric Co., Evendale, Ohio, construction and acquisition of facilities for aircraft nuclear propulsion development and testing, (PR 708749), $5157702.

AF OFFICE OF SCIENTIFIC RESEARCH, Air Research and Development Command, P. O. Box 1395, Baltimore 3, Md.

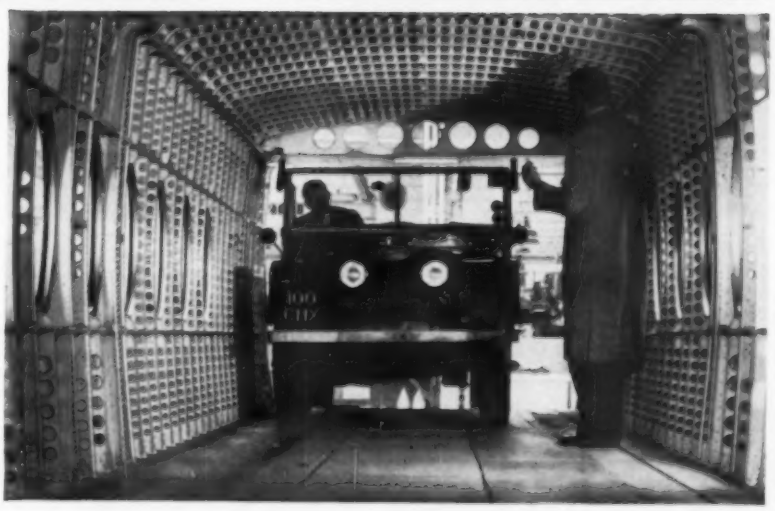
The University of Chicago, 5801 Ellis Ave., Chicago 37, Ill., research semiconductors and physical electronics (AF18 (603)-9), job, $40000.

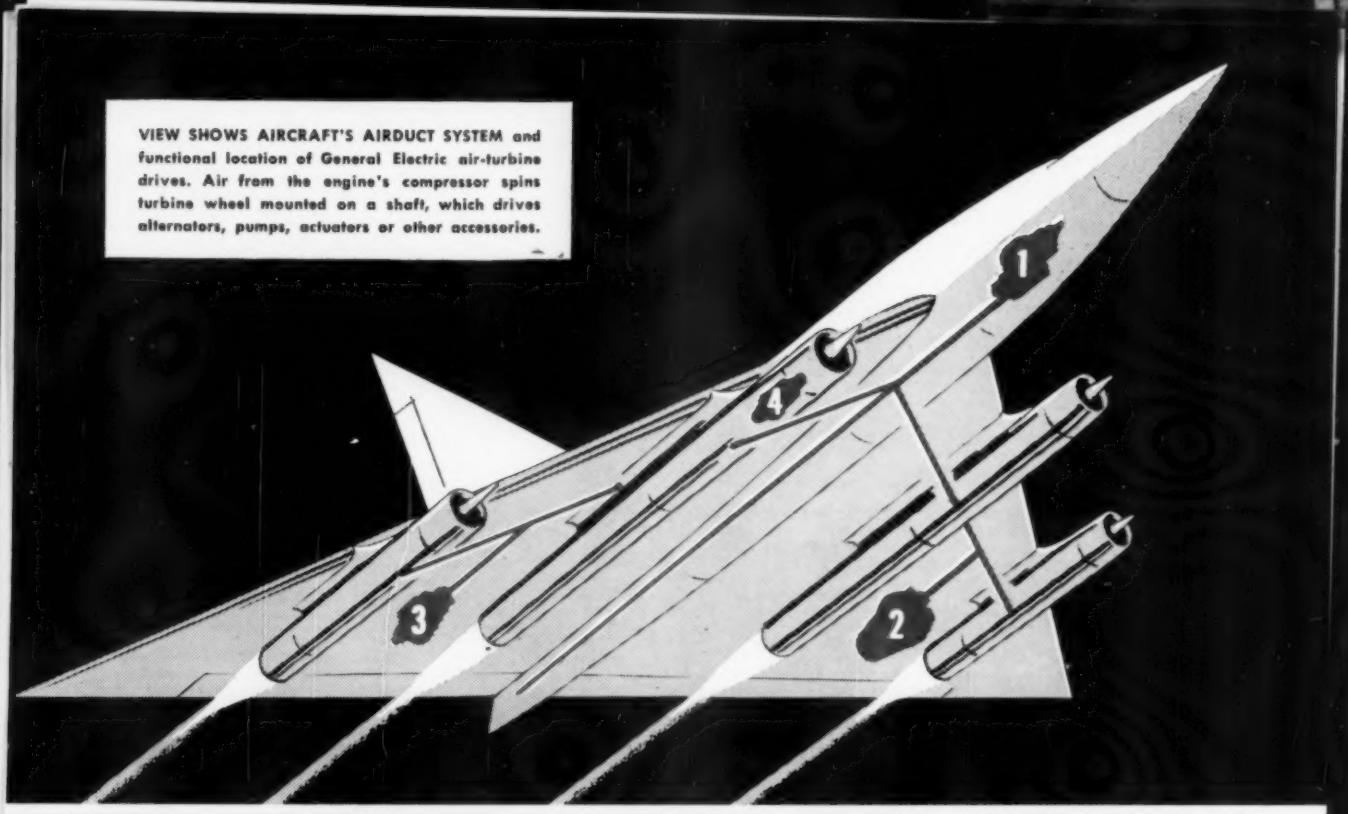
Polytechnic Institute of Brooklyn, 99 Livingston St., Brooklyn 1, N. Y., research, electromagnetic theory (AF18 (600)-1505), job, $66333.



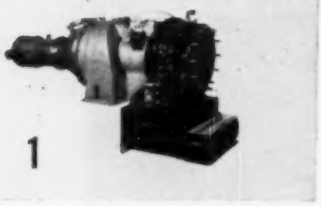
Loaded Rotodyne

Fairey Rotodyne, high-capacity rotary-wing transport, shows potential carrying capability in these pictures of vehicles loading. Clamshell doors at rear of the fuselage open laterally for easy access; floor bed is at standard truck-loading height. Internal width is great enough to handle standard cars and vehicles in the category of the Land Rover (below). Note clear floor and ceiling structure of the cabin interior. Rotodyne is powered by a pair of Napier Eland gas turbines driving propellers in forward and transition flight, and furnishing air to the rotor tip drives in vertical flight regimes. Afterburning is used at the tip drives for vertical flight.



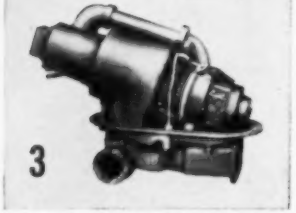


VIEW SHOWS AIRCRAFT'S AIRDUCT SYSTEM and functional location of General Electric air-turbine drives. Air from the engine's compressor spins turbine wheel mounted on a shaft, which drives alternators, pumps, actuators or other accessories.

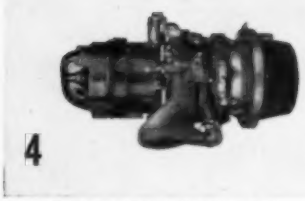


G-E TURBODRIVES ON THE B-52 supply 60 kva at 400 cps; perform under extreme operating conditions.

G-E HYDRAULIC TURBOPUMP, also used on the B-52 bomber, automatically delivers 8 gpm at 2650 psi.



G-E FUEL TURBOPUMP gives North American F-86D 86 gpm of vapor-free fuel for afterburner operation.



G-E TURBOSTARTER BURNS solid propellant to start Martin B-57. G.E. also makes fuel-air starters.

4 Ways to Meet Your Jet Age Accessory Power Needs

General Electric turbomotive accessory equipment can help you solve complex problems of heat, space, weight, and dependability. Designed to operate on the same ducted air which many of today's high-performance aircraft use for deicing, boundary-layer control and surface cooling, G-E air-turbines permit an effective integration of basic airframe and powerplant designs.

With over 200,000 flight operating hours, the units above are only a few of many configurations that can be engineered to your specific needs.

FOR ELECTRIC POWER—the G-E turbodrive with alternator is compact, easy to install and maintain.

FOR HYDRAULIC POWER—the G-E turbopump saves weight and space; improves aircraft performance.

FOR PUMPING FUEL—the G-E fuel turbopump gives instant power reserve; is light and small.

FOR STARTING JET ENGINES—G-E solid-propellant or fuel-air turbostarters give 20-second starts.

FOR MORE INFORMATION—Call your General Electric Aviation & Defense Industries Sales Office, or clip coupon for brochures on the air-turbines you're interested in.

Built by General Electric's Aircraft Accessory Turbine Dept., Lynn, Mass.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Send to: General Electric Company, Section B231-10, Schenectady 5, N. Y.

Please send me the following brochures on G-E air-turbines:

- ☐ GEA-5870A Air-turbine Drives for Jet Aircraft
- ☐ GEA-5871A Aircraft Afterburner Fuel Pumps
- ☐ GEA-6333 Hydraulic Turbopumps for Modern Aircraft
- ☐ GER-1088 Gas Turbine Starters for Jet Aircraft

Name .....

Position .....

Company .....

Street .....

City ..... State .....

CAB Accident Investigation Report:

C-46 Crash Caused by Structural Failure

N 9904F, a Curtiss-Wright C-46F, crashed in a cornfield near Hollywood (18 miles southwest of Charleston), S. C., at approximately 2040,[1] Dec. 17, 1955. The aircraft was destroyed by impact and fire which followed; both pilots, the only occupants, were killed.

The aircraft, operating as Riddle Airlines scheduled cargo Flight 207B, departed Idlewild Airport, New York, at 1557, Dec. 17, 1955, for Miami, Fla., with stops scheduled at Wilmington, N. C., and Jacksonville, Fla. It carried a cargo of dress goods and first-class mail. The pilots were Captain George Albert Lohr and Copilot Richard John Glendon.

Flying on a VFR flight plan the aircraft landed at Wilmington at 1857, and departed at 1936 again on a VFR flight plan, estimating Jacksonville at 2156. At approximately 2040, at a point near Hollywood, S. C., engines were heard by witnesses and lights were seen descending on an erratic path as the aircraft fell in several pieces to the ground.

INVESTIGATION

At the time of takeoff from Wilmington, N. C., the aircraft was loaded to a gross weight of 47,994 pounds (maximum allowable 48,000) and its load was properly distributed.

The position report transmitted to Myrtle Beach radio was "N 9904F VFR over Myrtle Beach radio 2003E en route to Jacksonville." This transmission was intercepted by Captain Norman Crull who was then near Charleston, S. C., northbound in another Riddle C-46. Direct radio contact was established between Crull and Lohr, who asked about surface winds, ground speed, and other conditions encountered by Crull enroute from Miami. Lohr made no comment about having any difficulty.

Captain Crull testified that his altitude was 7,000 feet and that he watched for but did not sight N 9904F; he concluded that Lohr's interest in surface winds indicated flight at low altitude, 2,000 to 4,000 feet. Except for a routine position report by N 9904F to Charleston Radio at 2032, Captain Crull's radio contact was the last made with Captain Lohr.

At 1927 and at 2027 on Dec. 17, the U. S. Weather Bureau at Charleston, S. C., recorded the following observations: Ceiling unlimited; visibility 7 miles; wind calm.

Captain George Albert Lohr and Copilot Richard John Glendon both held airline transport ratings. They had logged 10,000 hours and 3,300 hours, respectively. Captain Lohr has 731 hours in C-46 aircraft. Their records show they were competent for their assignments.

According to company records the aircraft had flown a total of 1,304:09 hours, of which 304:09 hours were since its major overhaul and its conversion from military cargo model C-46A to model C-46F under civil certification.

Pilot complaints of porpoising and of stiffness in the elevator tab controls were entered in the flight log of the aircraft on 11-28-55 and 12-2-55, and of porpoising owing to elevator controls or trim tabs or their rigging on 12-8-55, 12-11-55, 12-14-55, and 12-15-55. Maintenance entries in the flight log recorded a check of elevator tab rigging on 12-11-55, a change of tension on the elevator Vee tab rod on 12-14-55, and replacement of the right and left elevator spring cartridges on 12-15-55.

WRECKAGE DISTRIBUTION

The aircraft fragments fell to the ground within an area measuring approximately 2,500 feet north to south and 700 feet east to west.

The right wing was found 1,118 feet northeast of the main wreckage, the vertical fin approximately 937 feet northeast, the right stabilizer and an inboard elevator section approximately 1,380 feet northeast by east, and the left stabilizer and an inboard elevator section approximately 825 feet north. Most of the remaining empennage, sections of the flap and right wing, left wheel well doors, the three right wing fuel tanks, sections of windshield, and various other small parts were strewn over the same general area.

The main wreckage consisted of the fuselage, wing center section, right engine and propeller assembly, landing gears, and left wing. The entire left power package, including the engine, propeller, cowling, and the nacelle forward of the wing front spar, was found approximately 312 feet south of the main wreckage.

The fuselage, broken in two just forward of the cargo loading door, lay on its right side with the entire cockpit area demolished by fire. Fire damage extended along the floor from the nose and cockpit area rearward well beyond the trailing edge of the wing.

The left elevator and rudder spring cartridges were recovered but the right elevator spring cartridge was not found, although the bell crank to which it attaches was dug out of the ground at a depth of approximately two feet during a special search for the cartridge.

The entire right engine, with nacelle and propeller, was buried in the soft earth at approximately the center of the cockpit area with the right center section and the right inboard flap collapsed over it, and with charred cargo and the mangled overhead electrical panel over them. The left engine nose section was disintegrated and ground fire damage was evident around and to the rear of the carburetor as well as to the front and rear of the firewall on the left side. Careful examination of engines and propellers revealed no indication that they had malfunctioned in any way.

Nine pieces of the right horizontal tail were recovered. These accounted for the surfaces except for the portion of elevator between the third and fourth hinges from the tip. Examination of the stabilizer damage disclosed tension failures of the upper spar caps and stringers and compression buckling of those on the lower surface just outboard of the attach angles.

Outboard of the failure line there were dents and scratches on the leading edge, skin tears, and diagonal skin wrinkles caused by rearward-acting loads. The right elevator was severed at each of the four hinge stations, the most inboard failure being in line with the stabilizer failure. The portion of the elevator inboard of the fourth hinge from the tip was recovered at the main wreckage site in two pieces, both severely accordioned and flattened from inward-acting loads, indicating that they remained attached to the elevator torque tube through the fuselage until ground impact.

The end of the spring tab cartridge was still bolted to its mounting bracket in the accordioned piece of elevator leading edge, but the cartridge was broken off and missing.

The spring tab[2] was torn in two by downward bending just outboard of the control horn. The outer portion had little deformation outboard of the fracture, while the inboard portion was extensively crumpled indicating that it had remained with the main wreckage until ground impact. The spring tab push-pull tube was still bolted to the control horn.

Shaft Failed

At the forward end of the tube the fork end fitting of the spring cartridge[3] shaft was still attached, the shaft having failed from overload. The right elevator trim tab and its controls were intact. Although the bushing required by item 4 of Airworthiness Directive 47-51-2 was not installed, the idler rotated freely on the hinge bolt.

The left horizontal tail separated from the fuselage just outboard of the attach angles because of compression buckling of the stabilizer lower surface and tension failures of the upper surface. The upper surfaces of the stabilizer and elevator outboard of the second hinge from the tip were severely deformed by impact from an object moving downward.

The outline of this damage area con-

[1] All times herein are based on the 24-hour clock and are eastern standard.

[2] Spring Tab—A tab, spring loaded and connected to the primary controls in such a manner that control efforts by the pilot in excess of a fixed amount cause the tab to deflect and aerodynamically assist the pilot in moving the main control surface against the air forces on the surface.

[3] Spring Cartridge—A mechanism containing a double-acting compressed spring which holds the spring tab in its neutral position until control system loads applied by the pilot exceed a fixed amount.

forms closely to the shape of the tip and upper leading edge of the vertical tail. In this area there were numerous scratches in the surface of the skin. A small fragment of the Grimes anticollision light red filter was imbedded in the stabilizer between the tip hinge bracket and the closing skin.

The Vee tab[4] with its counterweights was still attached and its controls were intact. The tab control cables were broken about three feet inboard of the stabilizer failure.

At the bell crank on the left end of the elevator torque tube the tab push-pull rod end was bent upward and broken off after very extensive deformation. The spring cartridge fork end was broken off from bending loads, with the broken off portions still in the bell crank attachment. The spring cartridge remained attached in the elevator nose section with the shaft bent; this bend in the shaft restricted motion of the plunger on the shaft, resulting in the shaft being free to reciprocate through a small range without any spring load. This spring cartridge bore the stamp "US AIR."

The main portion of the fin was found in one piece. Directly above the leading edge fracture, the leading edge was deformed by impact loads and the deicer boot was cut and scratched. One to two feet above the leading edge fracture the nose radius was flattened to the left and rear and the surface of the deicer boot was severely scraped.

Above this area the leading edge in the deicer boot area was flattened to the right by impact forces, with rivet scratches in evidence on the skin behind the deicer boot. The left side of the tip section was crumpled and scratched by impact with riveted metal.

The Grimes anticollision light at the extreme tip of the fin was shattered by impact on the left side, as indicated by deformation of the base. At the bottom of the fin the skin, stringers, ribs, and multi-spars were severely fragmented by a combination of rearward impact forces and bending to the left.

The rudder was torn in two at the second hinge from the top. The lower portion of the rudder remained with the fuselage, held there by the push-pull rod still attached to the walking beam to which the rudder cables attach. The push-pull rods, walking beam at the fin spar, the spring cartridge, and the tab horn were still attached and in operable condition except that the spring tab shaft was bent, restricting the spring travel. The balance weight remained attached to the upper portion of the rudder. The spring tab and the lower portion of the trim tab were found at the main wreckage site with damage consistent with that to the lower portion of the rudder, indicating that they were still attached thereto until ground impact. The upper portion of the rudder trim tab with the push-pull tube, idler, and tab motor still attached were found at the main wreckage site. The fracture at the bottom of the tab was consistent with the rudder fracture directly forward thereof.

[4] Vee Tab—The left elevator trim tab on the C-46F; it has a spring-loaded shaft between the tab horn and the irreversible tab screw, and is rigged 20 degrees higher than the right elevator trim tab. When air forces on the Vee Tab produce more than a fixed load in the spring-loaded shaft, the Vee Tab will deflect downward and reduce the air forces on the tab until they balance the shaft load. This operation is designed to increase the longitudinal stability of the airplane.

Wings and Nacelles

The right wing outer panel failed just outboard of the attachment to the center panel. In the fuel tank area there were many indications of compression buckling of the lower surface skin, stringers and spar caps. On the upper surface the spar caps failed in tension after noticeable downward bending deformation. No evidence of fatigue cracking was found.

The three fuel tanks which had been installed in the right wing were separated therefrom. Each was bent downward near the inboard end, in the area which, when the tanks were in place, was directly in line with the outer wing panel failure. Examination of the right outer panel wreckage in the fuel tank area disclosed no bulging of skin, spar webs, and bulkheads in unstiffened areas or other structural deformation characteristic of explosions.

The wing center section and left outer panel remained with the airplane until ground impact, which severely shattered the center section. Fire after impact melted much of the outer panel.

The left nacelle, with powerplant attached, was separated from the left wing. The failure on the right side of the nacelle occurred in the upper portion of the attach angle to the front spar and also in the rivets holding the attach angle to the spar in the lower section. The top beam of the nacelle failed in tension and bending to the left at the aft rivets in the fitting in line with the front spar. On the left side, the part of the nacelle just forward of the wind front spar was disintegrated with deformation indicating compression buckling.

All primary system cables were traced and all attachments were found intact. Although the primary control cables were continuous through the auto-pilot servos, the servo shafts were bent from impact loads. The autopilot mechanism was so severely shattered that its condition before impact could not be determined.

HISTORY OF AIRCRAFT

Curtiss-Wright C-46F (converted from C-46A), N 9904F, was manufactured for the U. S. Air Force at a date which is not now available. This aircraft, serial No. 30262, bore AF No. 42-9660, was procured by the Air Force as a C-46A, and was operated without conversion until it was decommissioned and staked down for storage, with many other inactive aircraft, in the Egyptian desert. There it was abandoned.

Through a series of negotiations with the Government of Egypt, Officine Aeronavali of Venice, Italy, secured possession of this and several other aircraft, some of which, including this one, were sold to Aircraft Investment Company and were transferred by that company to Riddle Airlines on lease-purchase agreements.

Conversion

In the agreement Riddle was assured that this aircraft would be delivered in

To the ENGINEER of high ability

Through the efforts of engineers The Garrett Corporation has become a leader in many outstanding aircraft component and system fields.

Among them are:

air-conditioning
pressurization
heat transfer
pneumatic valves and controls
electronic computers and controls
turbomachinery

The Garrett Corporation is also applying this engineering skill to the vitally important missile system fields, and has made important advances in prime engine development and in design of turbochargers and other industrial products.

Our engineers work on the very frontiers of present day scientific knowledge. We need your creative talents and offer you the opportunity to progress by making full use of your scientific ability. Positions are now open for aerodynamicists ... mechanical engineers ... mathematicians ... specialists in engineering mechanics ... electrical engineers ... electronics engineers. For further information regarding opportunities in the Los Angeles, Phoenix and New York areas, write today, including a resumé of your education and experience. Address Mr. G. D. Bradley

THE GARRETT CORPORATION

9851 So. Sepulveda Blvd.
Los Angeles 45, Calif.

DIVISIONS
AiResearch Manufacturing, Los Angeles
AiResearch Manufacturing, Phoenix
AiResearch Industrial
Rex – Aero Engineering
Airsupply – Air Cruisers
AiResearch Aviation Service

Finer components mean better air data systems

AiResearch makes transducers, computers and indicators of superior sensitivity and accuracy in *all* required parameters. These can be combined into systems that provide the air data you require and convert it into any desired type of information or impulse. The products shown in the above illustration indicate some of the areas in which we are thoroughly experienced. If desired, we will take complete system responsibility. We invite inquiries to meet the most rigid specifications.

Qualified engineers are needed now. Write for information.

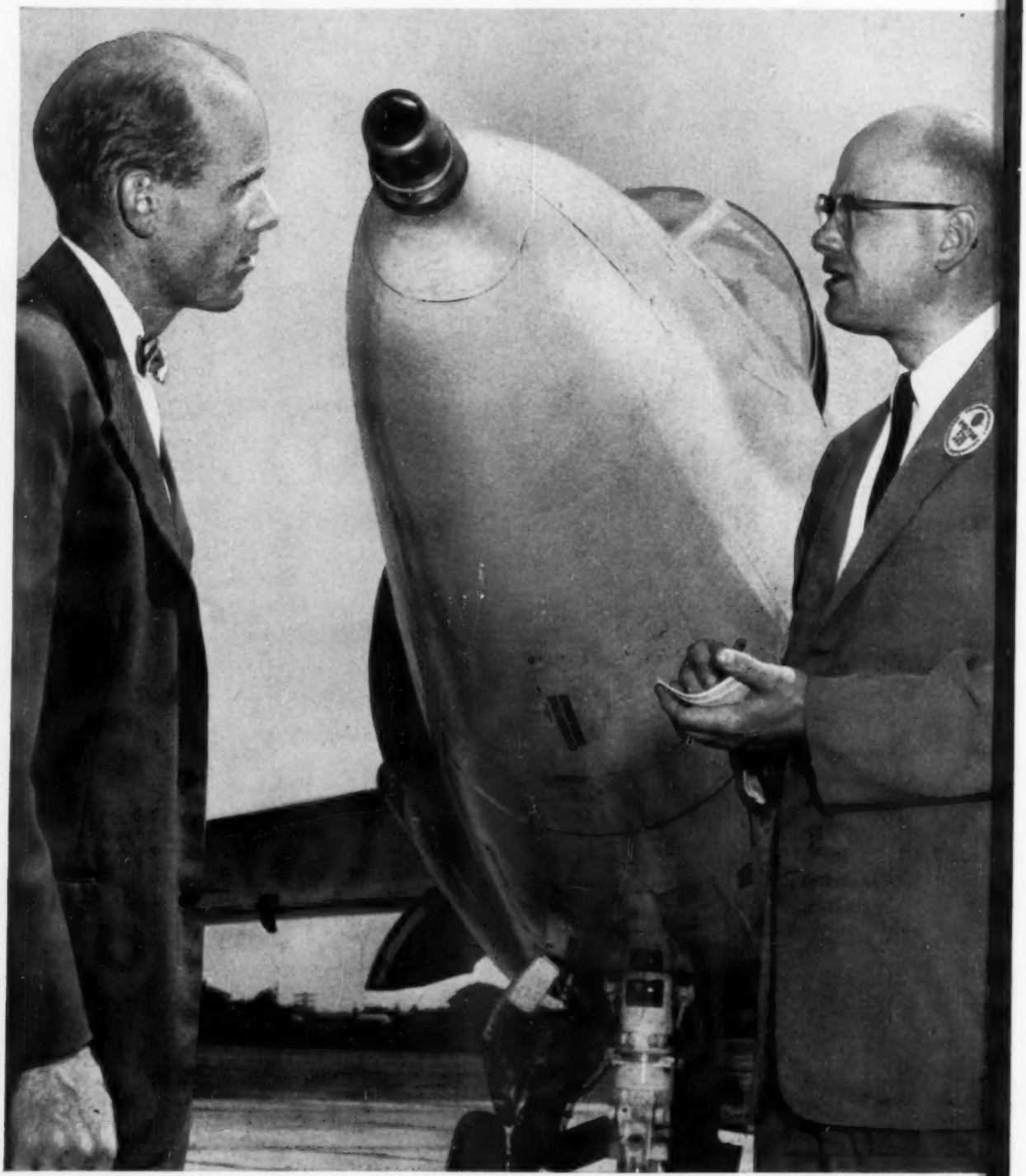
THE GARRETT CORPORATION

AiResearch Manufacturing Divisions

Los Angeles 45, California • Phoenix, Arizona

Designers and manufacturers of aircraft systems and components: REFRIGERATION SYSTEMS • PNEUMATIC VALVES AND CONTROLS • TEMPERATURE CONTROLS
CABIN AIR COMPRESSORS • TURBINE MOTORS • GAS TURBINE ENGINES • CABIN PRESSURE CONTROLS • HEAT TRANSFER EQUIPMENT • ELECTRO-MECHANICAL EQUIPMENT • ELECTRONIC COMPUTERS AND CONTROLS

His Story Line is Born o



Reading from left to right: Larry Mead, Project Engineer for Grumman Aircraft Engineering Corporation, the F11F-1 Grumman "Tiger" and Dave Anderton.

AVIATION WEEK has covered the "Tiger" since the first demonstration flights of this Navy fighter, which embodies the newest aerodynamic design principles.

on the Flight Line

Dave Anderton, Assistant Managing Editor of AVIATION WEEK,

Builds Top-Flight Reporting on First-Hand Experience

ON-THE-SPOT investigation is the policy that governs all technical reports which appear in AVIATION WEEK. In the past 12 months, Dave Anderton has made 38 trips into the field . . . visited every Research and Development Center of the USAF, covered missile development from New Mexico to the Bahamas—and many major aircraft plants here and abroad. 38 trips—38 stories for his magazine.

First foreign journalist to report on France's Dassault *Mystere* fighter, Dave even scored a beat on envious British journalists when he covered the Gloster *Javelin*, RAF operational fighter, while it still was an experimental project. Here at home, Dave lived—literally—at Boeing's Seattle plant during first flight tests of the 707 jet airliner.

He's just back from serving as a U. S. Delegate to the International Congress of Astronautics in Rome. At the same time, R. W. Martin, publisher of AVIATION WEEK, and Bob Hotz, Editor, were overseas for the airshow of the Society of British Aircraft Constructors; Hotz also attended the meeting of the International Air Transport Association in Edinburgh. Bill Jessup, Managing Editor, covered the Canadian International Air Show; Claude Witze, Military Editor, headed a five-man editorial team at the U. S. National Aircraft Show. No doubt about it—AVIATION WEEK editors get around!

In Dave's case, turning out definitive stories week after week comes naturally. Still in his thirties, he holds a Bachelor of Aeronautical Engineering degree from R.P.I., has served as a design engineer in prop-powered and jet-propelled aircraft projects. Before joining McGraw-Hill, Dave was project engineer for the *Hermes B* missile, and conducted a study on one ancestor of the ICBM—intercontinental ballistic missile.

Inside knowledge of the fields and problems of their readers is one of the reasons McGraw-Hill editors like Dave Anderton produce publications that lead in their fields. And McGraw-Hill has 485 full-time editors, backed by hundreds of correspondents, assigned to 34 publications. In the 16 specialized areas they serve, more than a million men pay to read McGraw-Hill magazines. They control specification and buying of your products and services . . . a market valued in billions of dollars that you reach for pennies per call with your advertising placed in McGraw-Hill magazines.

McGraw-Hill Magazines

McGraw-Hill Publishing Company, Incorporated
330 West 42nd Street, New York 36, New York

to the Engineer who seeks a wide variety of assignments

To non-aircraft engineers:

Aircraft experience is not necessary to join Lockheed. It's your engineering training and experience that count. Lockheed trains you for aircraft engineering — at full pay.

An unparalleled variety of assignments awaits you at Lockheed's Engineering Flight Test Division.

Lockheed diversification is the reason. This year alone flight tests must be conducted on new turbo-compound and prop-jet transports, extremely high-speed fighters, new types of jet trainers, patrol bombers, radar search planes and aerological aircraft. In development are jet transports and nuclear applications to aircraft and a large number of classified aircraft.

You not only work on many types of aircraft in Lockheed Flight Test, your work within each plane varies widely. Each flight test presents new problems, frequently requires new approaches.

Because of this, personal initiative is welcomed and rewarded at Lockheed.

Assignments are in fields of:

POWER PLANT: engine and after-burner; fuel systems; oil, fire extinguishing and air conditioning systems.

FLIGHT ANALYSIS: CAA certification, aerodynamic performance, data processing.

STRUCTURAL FLIGHT MEASUREMENT

INSTRUMENTATION: systems design, calibration and maintenance.

WEAPONS: fire control systems, ordnance, rocket sleds.

RADIO AND RADAR: communications, search radar, magnetometers ranging and sighting gear.

DYNAMICS: flutter, sound, vibration, autopilot and approach systems.

Positions are open for:

AERONAUTICAL ENGINEERS
MECHANICAL ENGINEERS
ELECTRICAL ENGINEERS
PHYSICISTS
ELECTRONIC ENGINEERS
CIVIL ENGINEERS
with and without aircraft experience

Brief résumé form at right is for your convenience in contacting Lockheed.

California Division

Lockheed

Lockheed Aircraft Corporation
Burbank **California**

E. W. Des Lauriers, Dept. VA-3-11-3
Lockheed Aircraft Corporation
Burbank, California

Name

Field of engineering

Home Address

Home Phone

Where employed

America in the condition described as a zero time C-46F eligible by conversion in accordance with Aircraft Specification 3A2 for certification as an air carrier aircraft with a permissible gross weight of 48,000 pounds.

To assist in completion of this complicated transaction Riddle sent personnel to Venice to expedite delivery to Aeronavali of the necessary technical information and material for accomplishment of the conversion to C-46F and its alteration under Specification 3A2. Acceptance of the aircraft in the United States was subject to Riddle's inspection upon delivery.

Aeronavali secured from Curtiss-Wright a license authorizing them to convert C-46's to C-46E's and a set of drawings relative to this conversion, which is identical to that for the C-46F insofar as the tail surfaces are concerned. However, Curtiss-Wright did not supply a complete set of the pertinent drawings or even a complete list of the drawings necessary to make up such a complete set.

Aeronavali's effort to make a satisfactory conversion also included purchase, in the United States from an American firm, of an approved kit of parts for a C-46F elevator. This kit (which was tagged with form ACA-186 certifying to its compliance with CAA approved data) was used in making up jigs for the production of duplicates of its components.

Officials of Aeronavali testified to the effect that where specified material was not available the nearest available material was used such as: Next thicker gauge in sheet dural, steel rods for dural rods, machined parts for castings, etc. In every case the strength of the material in the new part exceeded the strength of the material specified.

Many of the newly installed parts manufactured by Aeronavali were heavier than the original parts but the only vibration tests conducted were those in normal flight. No tests were conducted at maximum diving speed.

To prevent elevator flutter Aeronavali counterweighted the new elevators to provide the same spanwise center of gravity location and unbalance about the hinge line as found on the approved (Custom Air) elevator. Although the rudder was modified, it was not rebalanced at Venice because of lack of drawings.

While Aeronavali was doing this work they were visited by inspection personnel, including a representative of Riddle and personnel of CAA.

Upon completion of the work, the aircraft was weighed and test flown. A repair and alteration form ACA-337 was executed by a CAA-designated aircraft maintenance inspector (DAMI) employed by and stationed with Aeronavali in Venice. At the suggestion of CAA, Paris, the aircraft was only registered and was given a ferry certificate for its flight to the United States. Later a standard cargo airworthiness certificate, dated October 15, 1955, was issued for the aircraft in Venice by the above inspector. At the suggestion of CAA, Paris, he inserted above his signature on Form 337 the comment, "Subject to final engineering approval."

In the course of the investigation the rudder, elevators, their tabs, and their con-

Aren't these the 5 things ENGINEERS want in their JOBS?

By—CHARLES E. CLEMINSHAW
Vice President, Engineering, Parker Aircraft Co.

In the past few years we have talked to scores of engineers of all ages, talents, and temperaments. We have talked to them about many things, but mostly about what they *wanted* in their jobs.

Here's what engineers seem to want . . .

1. SATISFACTION AND SELF EXPRESSION We found that most engineers wanted to be engaged in honest, useful work which was interesting and challenging. Pride of organization was important, and many liked to meet the challenge of trying to design and build a better unit than the competition. One of the big gripes we heard was about the impersonal, production-line atmosphere that prevails in some companies—where a fellow finishes a drawing, shoves it through a hole in the wall and never sees hide nor hair of it again. Such is not the case at Parker, where our fellows have a chance to see what happens to their brain-children—to discuss and supervise and help develop a project from start to finish. As key men on the Parker Team, our engineers participate in the original discussion about requirements with the customer. All of this is possible in a company of our size (800 employees) which is large enough to provide adequate facilities and get things done, but is not so large that a man is likely to become lost and perhaps restricted to a narrow, specialized assignment.

2. SECURITY Some engineers seem to have "cancellation jitters" when they are working on a single large Government contract which may be cancelled or cut back at any time. The work at Parker is diversified. We design and build products for many customers—including every manufacturer of airplanes or engines. We are dedicated to a solid, long range growth in the field of "fluid handling." We specialize in fuel systems equipment, air control and regulating valves, hydraulic system components, and in research and development projects created by new fuels, higher temperatures, and the more complicated devices required on missiles and high speed jet aircraft.

3. INCOME Salaries at Parker are based upon the engineering ability of the individual. On some jobs, such as that of Design Specialist, there is no limiting salary ceiling. Many jobs participate in a bonus which is based on company profits, and all salary personnel participate in a profit sharing-retirement plan which is financed entirely by Parker. Most important of all is the fact that each man is paid more money as fast as he is able to qualify. There is no rigid "table of organization" to block promotions.

4. SELF IMPROVEMENT We believe in developing well-rounded engineers who know about a variety of products and who have continuing experiences in design problems, laboratory testing, manufacturing processes, and customer contacts. In addition to the on-the-job training, engineers are given the opportunity to round out their education at one of the many technical schools in Los Angeles, and Parker pays the bill. We pride ourselves on helping men in other fields to adapt their talents and experience to our work. This is done by organizing small design teams headed up by Parker engineers who help train the new men.

5. LOCALE, ATMOSPHERE, ENVIRONMENT Parker offers many advantages as a pleasant place in which to work. Our plant is located on ten acres at the International Airport with plenty of convenient parking. We are close to the ocean in a practically smog-free area and within a short distance of several of the larger aircraft companies. Many of our employees live within a few minutes of the plant in one of a dozen new, clean, modern suburban developments offering a wide variety of desirable places to live.

If the thoughts expressed above appeal to you, ***there's a place on the "Parker Team" for you.*** Drop me a note telling me who you are, what you have been doing, and why you might be interested in joining the Parker team.

Please write me personally:

CHARLES E. CLEMINSHAW, *Vice-President*,
Parker Aircraft Co.
5827 West Century Boulevard
Los Angeles 45, California

Parker
Hydraulic and fluid system components

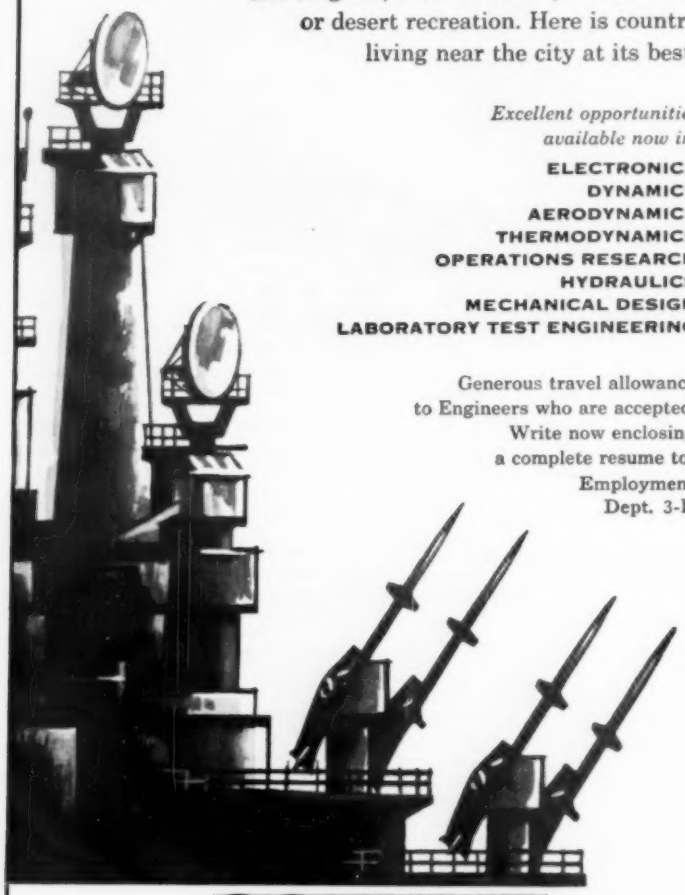
ENGINEERING UNLIMITED

...an established concept at Convair-Pomona where your opportunities in the career of your choice are virtually unlimited. Work in the finest engineering facility in the country at America's first exclusive Guided Missile plant. Ultra-modern surroundings, completely air-conditioned, in beautiful Pomona only minutes from Los Angeles, the mountains, the seashore or desert recreation. Here is country living near the city at its best:

Excellent opportunities available now in:

ELECTRONICS
DYNAMICS
AERODYNAMICS
THERMODYNAMICS
OPERATIONS RESEARCH
HYDRAULICS
MECHANICAL DESIGN
LABORATORY TEST ENGINEERING

Generous travel allowance to Engineers who are accepted. Write now enclosing a complete resume to:
Employment
Dept. 3-F



CONVAIR
A DIVISION OF
GENERAL DYNAMICS
CORPORATION
POMONA
CALIFORNIA

trol mechanisms were compared with applicable Curtiss-Wright drawings specified on a drawing list provided by the Civil Aeronautics Administration. This comparison disclosed many nonconformities, a few of which are described below. Variations from specified dimensions, materials, and surface finish, together with a bow in the shaft, resulted in binding in the spring-loaded elevator Vee tab shaft assembly.

The left elevator spring tab cartridge assembly had two concentric springs, neither of which conformed to the single spring specified.

Both the inside surface of the larger spring and the outside surface of the smaller spring were polished by mutual interference in operation. In addition, the inside surface of the smaller spring and a collar on the shaft which extends through the spring were polished by interference with one another. Instead of bronze, oilite steel that was not corrosion resistant was used to make the plungers at the ends of the springs.

On the right and left elevator spring tab push-pull tubes which parallel the elevator torque tube, the clevises attaching to a common bolt at the centerline of the airplane were made symmetrical instead of offset. This caused misalignment of the tubes. Skin gauges on the elevators and tabs were found to be heavier than specified.

Since both the right and left elevators and elevator tabs of the aircraft were severely distorted, with portions missing, it was impossible to determine the balance of these assemblies experimentally. To approximate the elevator balance it was decided to remove the balance weights from the N 9904F assemblies and install them on a right-hand elevator assembly in possession of Riddle Airlines which was reported to be a spare manufactured by Aeronavali about the same time as those on N 9904F.

Balancing of this assembly indicated that the unbalance as measured from the hinge line was about half of the maximum permitted and the spanwise location of the Cg was farther inboard.

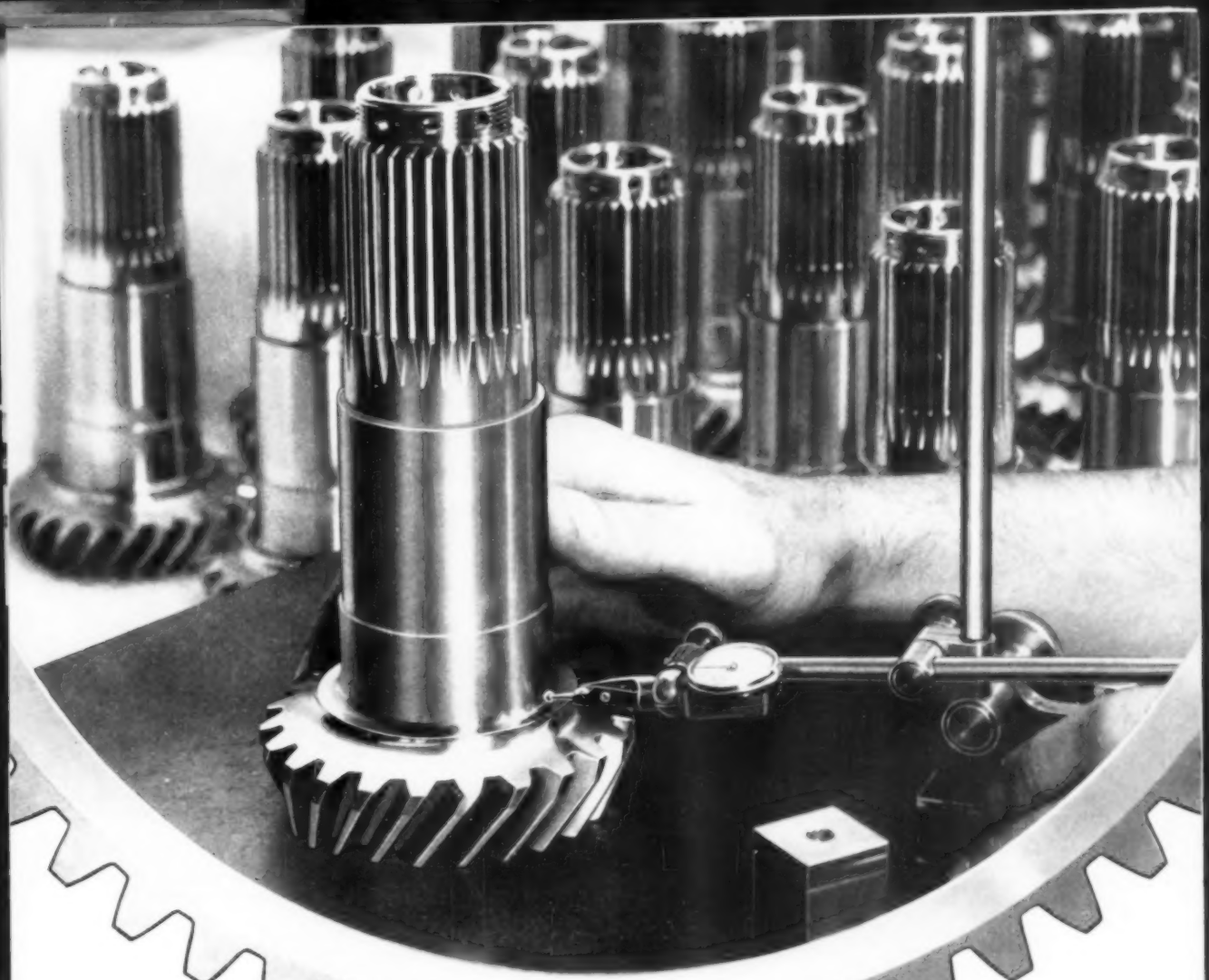
ANALYSIS

Ground impact marks made by dense pieces of the aircraft indicate that these parts were descending almost vertically. This and the scatter of wreckage, prove that distintegration occurred at an appreciable altitude.

Examination of the wreckage disclosed that the left horizontal tail failed downward after it received a severe downward impact from the fin structure. Both the leading edge of the fin and the leading edge of the right horizontal tail were dented and scratched by impact with rearward moving objects. In addition, the fractures near the root end of the right horizontal stabilizer showed strong evidence of rearward tearing along with downward failure.

Portions of the detached right wing also showed evidence of impact with other objects.

From the above, it can be concluded that the right wing failure occurred before the structural failures of the tail surfaces and that portions of the separated right



Power take-off pinion, helicopter transmission. Carburized, hardened and unground-interchangeable spiral pinion. Bearing diameters and pitch diameters of spline and gear to be concentric within .002"

PRECISION
is Our *Only* Product!

● Everything at I.G.W. is geared to precision. You'll find a "feeling" for precision not just in inspection and production and engineering, but also in maintenance and shipping and on throughout the company. It's the basic reason why I.G.W. is *the* recognized source for precision gears

Indiana Gear Works, Inc., Indianapolis 7, Indiana

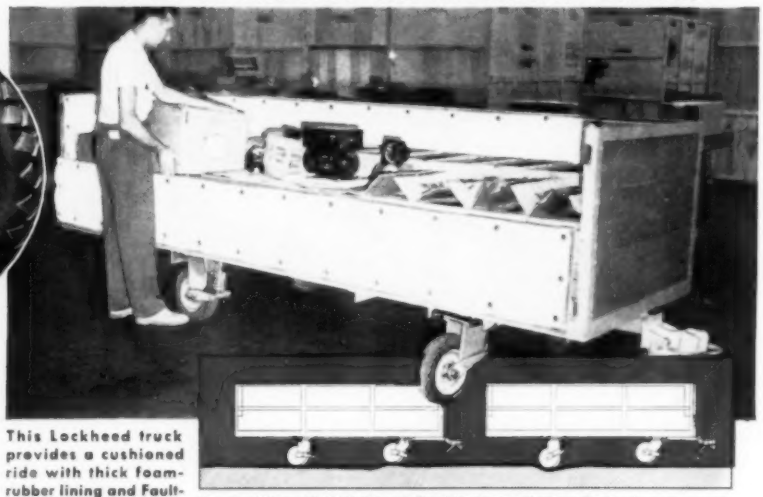
NOELTING

HOW Faultless AIRMASTER CASTERS ARE SERVING AVIATION

LOCKHEED AIRCRAFT CORP., MARIETTA, GEORGIA ... MOVES FRAGILE INSTRUMENTS SAFELY

SERIES SH300

Time-tested by the Aviation industries, this Faultless Caster is acclaimed for its use of standard, interchangeable wheels . . . absorption of high impact shocks through use of large, durable springs under constant compression . . . spring and draw bar assembly a separate, interchangeable member. Choice of spring tensions allows specialized use of this caster, according to loads carried and terrain encountered.

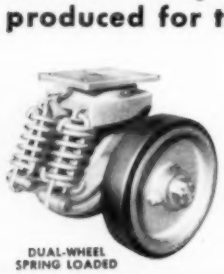


This Lockheed truck provides a cushioned ride with thick foam-rubber lining and Faultless Double Action Spring Casters.

The Faultless SH 332-12 x 3 Double Action Spring Caster has a unique construction that maintains a level load on trucks when moving over irregular floors. Wheels contact floor surface at all times—eliminate bounce—don't raise truck when mounting obstacles or drop when passing over depressions in the floor.

How Lockheed Aircraft Corporation, Marietta Division, materials handling engineers move the B-47's multitude of electronic devices provides the basic information of how your own materials handling problems may be solved. A truck was needed to move the airplanes' electronic equipment without damage. In order to facilitate their movement and carry the load safely through the production locations and inspection stations, the Transportation Department of Lockheed decided upon a foam-rubber lined truck mounted on Faultless Double Action Spring Cushion Casters equipped with pneumatic wheels. Faultless Casters were selected since they best fulfilled the requirements of providing a smooth, jolt-free, low cost ride for the electronic instruments. We can solve *your* caster problems, as we have for many in the industry. Simply call your local Faultless Caster Distributor listed in the yellow pages of your phone directory, or write us today.

Two of many AIRMASTER Casters produced for the Aviation Industry



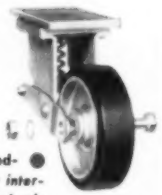
DUAL-WHEEL SPRING LOADED

Made in accordance with Military Specifications. Write for specification data.

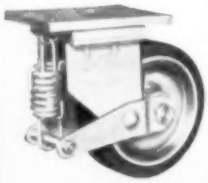
SPRING ACTION POSITION LOCK ON SWIVEL

3 FEATURES EXCLUSIVE WITH AIRMASTER CASTERS

● **Shock-Absorbing Spring Action *parallel to the center line of King Bolt* to balance the load and allow wheel to be in contact with floor at all times, regardless of rough floors or bumpy terrain.**



● **Caster wheels of standard design are *easily interchangeable with stock wheels* to minimize maintenance and "down" time.**



● **Spring Action Caster *continues to function as conventional Caster* in case overload exceeds maximum spring load rating. An important safety factor to load and operators.**

FAULTLESS CASTER CORPORATION

EVANSVILLE 7, IND.

Offices in Atlanta, Baltimore, Boston, Buffalo, Chicago, Cleveland, Dallas, Detroit, Grand Rapids, High Point, Indianapolis, Los Angeles, New Orleans, New York, Philadelphia, Portland, Seattle, St. Louis, Toronto, Montreal, Winnipeg

outer wing striking the tail surfaces contributed largely to their failure.

Disintegration of large cargo aircraft in flight is indeed a rare occurrence and the recorded data on such accidents does not establish any pattern helpful in explaining the separation of the left engine nacelle from the wing, with indications of outward loading.

From the closeness of the nacelle and main gear doors of the fuselage wreckage it is apparent that the nacelle failure, which had caused the gear doors to be distorted to the left and torn off, occurred late in the sequence of structural disintegration, after the right wing and tail surfaces had separated from the airplane and the main wreckage had descended appreciably. It appears probable, therefore, that the nacelle failure was caused by abnormal inertia loads resulting from the uncontrolled gyrations following failure of the wing and tail surfaces.

The nature of the structural distortions at the right outer wing panel and the downward deformation near the inboard end of all three separated fuel tanks indicate conclusively that the lower surface of the right outer wing panel buckled under high compressive loads and the wing bent downward before the upper surface failed.

This sequence of failure results from downward acting loads on the wing which produce stresses in excess of the wing strength. Although such loads can be caused by gusts, all available evidence indicates that the weather at the time and place of the accident did not include the strong vertical movements of the air necessary for such gust intensities. As a result it can be concluded that excessive loads were imposed on the wings by other causes.

Excessive negative loads on the wing during cruising flight are likely to result from either failure or erratic operation of the horizontal tail surfaces. Since analysis of the damage indicates that failure of the tail surfaces resulted from, rather than caused, the wing failure, it appears most likely that the wing failure was caused by erratic operation of the horizontal tail controls.

Flutter

One possible cause of erratic operation is flutter. Although numerous nonconformities in the elevators and tab controls caused the elevator assemblies to be overweight, an approximate check of the balance by use of another similar elevator indicates that both the unbalance and the spanwise location of the center of gravity of the elevator assembly were less than the maximum permitted for flutter prevention. It appears, therefore, that flutter did not occur.

Another possible cause of erratic operation is malfunction of the autopilot. Because of the severity of damage received on impact and in the subsequent fire, it was impossible to prove or disprove this possibility. In the records of this aircraft's operation there was no mention of any difficulty or malfunction of the autopilot except for low vacuum and undesired sensitivity which was corrected by adjustments made by ground crew.

Although examination of the elevator and

EMPLOYMENT OPPORTUNITIES

NATIONAL COVERAGE

DISPLAYED ——RATES—— UNDISPLAYED

The advertising rate is $27.60 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

An Advertising inch is measured 7/8" vertically on a column—3 columns—30 inches to a page.

Subject to Agency Commission.

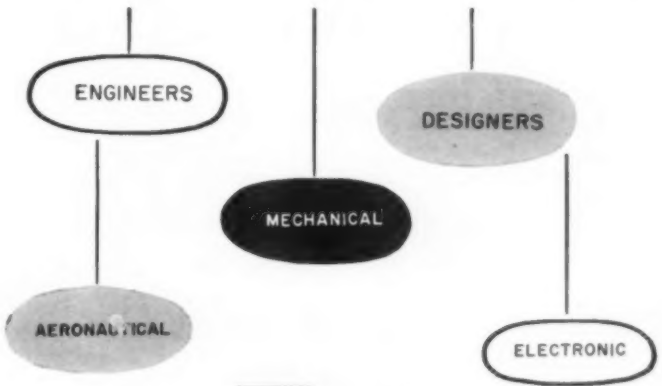
$2.10 per line, minimum 3 lines. To figure payment count 5 average words as a line. Box numbers—counts as 1 line.

Position Wanted ads are 1/2 of above rate.

Discount of 10% if full payment is made in advance for 4 consecutive insertions.

Not subject to Agency Commission.

Send NEW ADS to AVIATION WEEK Classified, P.O. Box 12, N. Y., for Dec. 3rd issue closing Nov. 22nd.



Bendix

Provides MIDWEST Opportunities for Experienced Engineers

In South Bend, hundreds of professional people have found a community adequately satisfying for a highly educated way of life. Notre Dame is an excellent center for technical, graduate study, as well as affording cultural opportunities.

Immediate openings available in research, design, test and development:

AIRCRAFT JET FUEL SYSTEMS → Electro-Mechanical Design, Magnetic Amplifiers, Nuclear Control Applications, Rocket Circuitry, Servo-Mechanisms, Systems Evaluation, Thermo-dynamics, Transistorization, Vibration Analysis

AIRCRAFT LANDING GEAR → Computer Applications, Heat Transfer, Stress Analysis, Structure, Systems and Component Design or Testing

AUTOMOTIVE COMPONENTS → Conventional Brakes, Hydraulic Systems, Mechanical Design and Test, Power Brake Research, Power Steering

If you are interested in any of these engineering projects, send a summary of education and experience to:

Technical Employment,
Department A-6,
BENDIX PRODUCTS DIVISION OF
BENDIX AVIATION CORPORATION
401 Bendix Drive
South Bend, Indiana

Immediate Openings for

HIGH LEVEL ENGINEERS

SENIOR PROJECT ENGINEER

For Gas Turbine Development

CHIEF EXPERIMENTAL ENGINEER

For Gas Turbine Development

PROJECT ENGINEERS

For Pneumatic Ducting,
Gas Turbine Production

Solar's present expansion program has resulted in several desirable openings for high level engineers to work on advanced development and production projects. Here is an unusual opportunity. Advance your career at Solar...while enjoying the unique delights of San Diego's year-round, moderate, sunny climate. Take advantage of this opportunity created by the expansion of Solar's Engineering Division. Please send a resumé of your qualifications and education to Louis Klein, Dept. E-118, Solar Aircraft Company, 2200 Pacific Highway, San Diego 12, Calif.

SOLAR AIRCRAFT COMPANY — SAN DIEGO, DES MOINES

Designers, Developers and Manufacturers • Gas Turbines • Aircraft and Missile Components • Bellows • Controls • Coatings • Metal Alloy Products

Solar also has permanent openings for:

CONTROLS ENGINEERS • DESIGN ENGINEERS

DESIGNERS • DRAFTSMEN • CHECKERS

ENGINEERING WRITERS

elevator tab controls did not disclose evidence to prove beyond doubt that malfunctioning of these controls caused the airplane to pitch down and overload the wing, it did disclose evidence that indicated this possibility.

One possible cause is the noted binding in the spring-loaded Vee tab push-pull tube, which resulted from a bow in the shaft and numerous nonconformities in its construction. Pilot entries in the flight logs of the aircraft disclose records of repeated "porpoising" because of malfunction in the elevator or elevator tab controls.

A possible cause of violent maneuvers and concurrent excessive loads is erratic action of the elevator spring tab cartridges. The nonconforming plungers in the recovered left-hand cartridge could have caused binding on the shaft. Wear marks on the nonconforming springs and shaft collar indicate the possibility of erratic action owing to mutual interference.

Although the condition of the missing right-hand cartridge is unknown, there is no reason to believe that it was better than the left-hand cartridge and its condition could have been worse. The fact that these spring cartridges were installed in the airplane the day before the accident also tends to indicate the possibility of their malfunctioning having contributed to the accident.

Binding

Nonconforming clevises found on the elevator spring tab push-pull rods which parallel the elevator torque tube could also cause binding due to inadequate clearance of the rods with respect to other parts on the elevator torque tube.

Considering the above-mentioned nonconformities, together with others found during examination of the elevator tab controls, it appears likely that their cumulative effects could very well have caused sufficient erratic action of the tabs to pitch the airplane nose-down and produce excessive negative loads on the wing.

These nonconformities were not detected by personnel of CAA, partially because of the unusual handling, through international channels, and partially because of the nonavailability of a complete central file of technical data on the various models of the C-46 aircraft.

Since N 9904F had never before been certificated by CAA and ACA-337 is a form for recertification of aircraft after repair and/or alteration, this form was erroneously executed and was not processed in a manner that would bring it and the DAMI's comment to the attention of CAA Engineering for consideration and final approval.

Further Alterations

At Miami, Riddle made further alterations to fit N 9904F into its fleet. These included replacement of propellers, radio, and instruments, and the routine airworthiness inspections but did not include any check for conformity with requirements for C-46F (despite the DAMI's comments on form 337 the need of checking conformity was overlooked).

As a result of this accident and its investigation, the Board called to the attention of the Administrator of Civil

Aeronautics the nonconformities found in the aircraft and the nonavailability of complete files of drawings. In reply, on March 22, 1956, the Administrator reported that CAA had taken measures to prevent recurrence of these nonconformities, the unavailability of accurate information and drawings, and the shortage of legitimate replacement parts.

In view of nonconformities and other discrepancies found in C-46 aircraft modified by the agency involved, the designated aircraft maintenance inspector was requested by the CAA Administrator to discontinue all DAMI functions pending further investigation of the reported difficulties. The agency was also informed that no further certification would be performed at Venice until a complete review had been conducted and all necessary data were available to assure full compliance with applicable requirements of the Civil Air Regulations. Aircraft subsequently modified for Riddle Airlines have been ferried to the United States for inspection and certification.

In addition, the CAA issued Air Carrier Maintenance Alert Bulletins #235 and #240. Several conferences were held at Venice, Italy; Paris, France; Miami, Florida; and Washington, D. C., with the objectives to make known the fact that unsafe parts have been manufactured, to bring into being an adequate supply of safe, legitimate parts, and to establish appropriate drawing lists for pertinent type certificates.

As a matter of further interest, an investigation has been undertaken by CAA with respect to C-46 nonconforming parts, which are appearing in increasing quantities owing to the present shortage of legitimate parts. Many of these parts have the appearance of genuine parts and carry numbers and other identification established by the original manufacturer.

FINDINGS

On the basis of all available evidence the Board finds that:

1. Certification of the crew was in order.
2. The aircraft was loaded within prescribed limits of weight and center of gravity.
3. No indication of fatigue cracking, fire, or explosion in flight was found.
4. The right outer wing, the tail surfaces, and the left engine nacelle separated from the aircraft in flight.
5. Downward failure of the right wing from excessive aerodynamic loads was first in the sequence of structural failures.
6. Numerous nonconformities were found in the elevator tab controls; some of these showed evidence of having caused erratic action of the elevator tabs.
7. These nonconformities made the airplane ineligible for airworthiness certification.
8. Both the Civil Aeronautics Administration and Riddle Airlines should have detected the nonconformities.
9. The cumulative effect of these nonconformities produced a pitch-down of sufficient severity to cause failure of the right wing.

PROBABLE CAUSE

The Board determines that the probable cause of this accident was an inflight structural failure resulting from a violent pitch-

This coupon mailed TODAY

...may bring you a brighter TOMORROW!

There just isn't any question about it—the trained engineer of today has more opportunity than ever before.

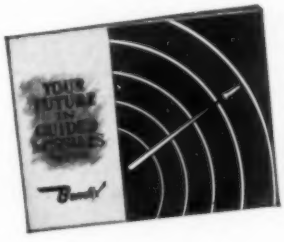
However, and this is vitally important, the possibility for individual progress is far greater in certain organizations than in others. That's why every engineer concerned with his future should look into the job opportunities offered in the guided missile field.

Here at Bendix Products Division—Missiles, you can get in on the ground floor of a new, but proven, dynamic business with long-term potentials in the development, engineering and manufacturing of the nation's most important weapons system. It is truly the business of the future with many commercial as well as military applications.

Then, too, at Bendix Products Division—Missiles, you have all the advancement possibilities of a compact, hard-hitting organization backed by the resources of the entire nation-wide Bendix Aviation Corporation.

So that you may analyze for yourself the various job opportunities and the possibilities of rapid advancement, we have prepared a thirty-six-page book which gives detailed background of the functions of the various engineering groups.

Any ambitious engineer looks forward to a brighter tomorrow. May we suggest that the first step toward this goal is the mailing of the coupon for your copy of "Your Future in Guided Missiles".



Prime Contractor for TALOS MISSILE

EXECUTIVE OPPORTUNITIES IN THE CESSNA SALES DIVISION

REGIONAL SALES MANAGERS

- Executive management experience necessary in initiating and administering sales programs.
- Experience in supervising and directing a sales organization.
- Aircraft background desired.

REGIONAL SERVICE MANAGERS

- Travel out of and headquarter in Wichita.
- Aircraft maintenance background desirable.
- Must be competent pilot.

PARTS MERCHANDISING MANAGER

- Must develop and administer a spare parts merchandising program.
- Must aid dealers in setting up and operating parts departments.
- Must have automotive parts experience on zone manager level.

CESSNA

If you meet these requirements and are interested in an unlimited opportunity with the World's Leading Producer of Executive Aircraft, send your resume and recent photograph to the Professional Placement Supervisor, Dept. AW, Cessna Aircraft Company, 5800 East Pawnee Road, Wichita, Kansas. (No phone calls, please.)

ENGINEERS

Mechanical Design at the Small Aircraft Engine Department of General Electric

MEANS MORE CAREER POTENTIAL

You'll be working on such advanced and stimulating problems as how to develop a gas turbine with a power-weight ratio of more than 4 to 1—in the class of our T58, which delivers 1050 HP, weighs only 325 lbs.

It involves the design of a variety of static and moving parts: compressors, combustors, turbines, control components, gear and lube systems.

It requires men with knowledge of high speed machine design, and experience in any of the following fields:

- stress analysis
- experimental analysis of mechanics
- solid mechanics
- vibrations analysis
- mechanical analysis

And at this young, decentralized department an able man quickly advances to a position of responsibility, aided in every way by General Electric's outstanding benefits and a professional development program. And Boston's cultural and educational facilities —plus the recreational advantages of all New England—are within easy reach.

Write in complete confidence to:

Mr. T. S. Woerz (Section R-A-1)

Small Aircraft Engine Dept.

GENERAL ELECTRIC

1000 Western Avenue, West Lynn, Mass.

down induced by the erratic action of nonconforming elevator tab controls.

By the Civil Aeronautics Board:

/s/ James R. Durfee
/s/ Harmar D. Denny
/s/ G. Joseph Minetti

Adams, Vice Chairman, and Gurney, Member, did not participate in the adoption of this report.

SUPPLEMENTAL DATA

The Civil Aeronautics Board was notified of this accident at 2255 on Dec. 17, 1955. An investigation was started immediately in accordance with the provisions of Section 702 (a) (2) of the Civil Aeronautics Act of 1938, as amended. Depositions were taken at Miami, Fla., on Jan. 31, Feb. 1, and April 13, 1956, and at Hollywood, S. C., on Feb. 2, 1956.

Air Carrier

Riddle Airlines, Inc., is a Florida corporation engaged in scheduled cargo service under certificates of public convenience and necessity issued by the Civil Aeronautics Board and air carrier operating certificates issued by the Civil Aeronautics Administration. The certificates authorized flight between New York, N. Y., and Miami, Fla., and other points.

Flight Personnel

Captain George Albert Lohr, age 31, was employed by Riddle Airlines as a pilot on Feb. 1, 1953, and was promoted to captain Mar. 1, 1953. He held a valid airline transport pilot certificate with a rating for the subject aircraft. Captain Lohr had approximately 10,000 flying hours, of which 731 hours were in C-46 aircraft. He successfully passed a class one Civil Aeronautics Administration physical examination, no waivers, on June 17, 1955.

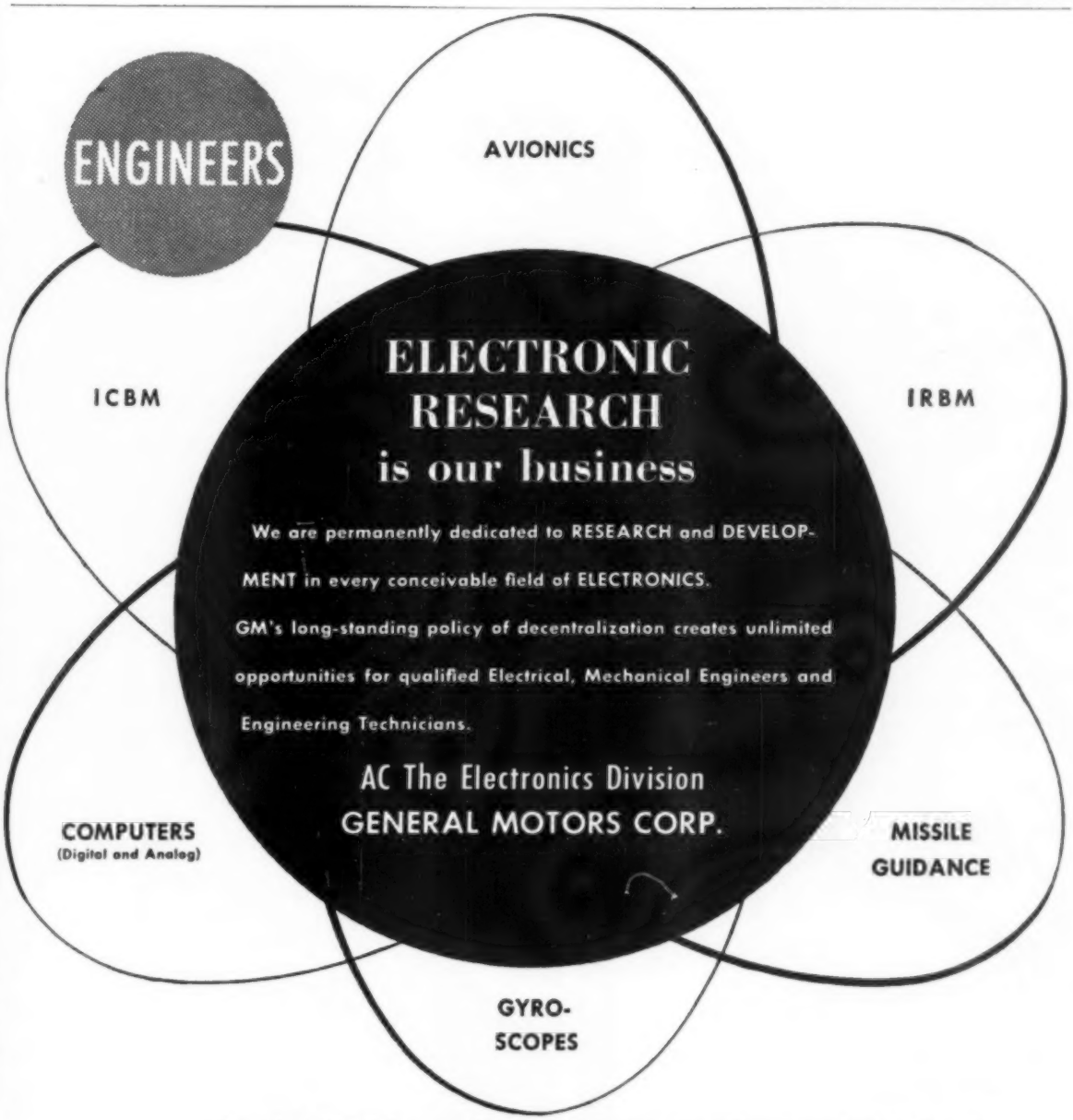
Copilot Richard John Glendon, age 36, held a valid airline transport pilot certificate with a rating for the subject aircraft, and had flown approximately 3,300 hours. He successfully passed a class one physical examination, no waivers, on June 24, 1955.

The Aircraft

N 9904F, a Curtiss-Wright C-46F, serial number 30262, was owned and operated by Riddle Airlines, Inc., and was certificated by Civil Aeronautics Administration under type certificate #3A2. It was equipped with two Pratt and Whitney R-2800-75 engines and two Hamilton Standard propellers with model 23E50-505 hubs and model 6491A-6S blades. The aircraft had been operated by the United States Air Force in the European Theatre and had been staked out as an inactive aircraft in the Egyptian desert for some time prior to its conversion to a C-46F.

Lockheed Aircraft Shop Turns Out 2,094 Jobs

Lockheed Aircraft Service-International, Inc., New York aircraft maintenance and repair shop, turned out 746 aircraft during third quarter of 1956, making a total of 2,094 since Jan. 1. Commercial four-engine aircraft accounted for major portion of work-load.


ENGINEERS
AVIONICS
ICBM
IRBM
ELECTRONIC RESEARCH is our business
We are permanently dedicated to RESEARCH and DEVELOPMENT in every conceivable field of ELECTRONICS.
GM's long-standing policy of decentralization creates unlimited opportunities for qualified Electrical, Mechanical Engineers and Engineering Technicians.
AC The Electronics Division
GENERAL MOTORS CORP.
COMPUTERS
(Digital and Analog)
MISSILE GUIDANCE
GYRO-SCOPES

New plant (225,000 square feet) now being built in a Milwaukee suburb. This and our present plant will house the ELECTRONICS DIVISION—Milwaukee of the General Motors Corporation.

Your future is assured (if you can qualify) in this lovely cool, southern Wisconsin city where every conceivable living and cultural advantage, plus small town hospitality is yours for the asking. Send full facts today about your education, work background, etc. Every inquiry treated in strict confidence—and you will hear from us by return mail.

For Employment Application — Mr. John F. Heffinger, Supervisor of Salaried Personnel

AC THE ELECTRONICS DIVISION
GENERAL MOTORS CORPORATION
Milwaukee 2, Wisconsin Flint 2, Michigan

Take command of your future

FLY AS A CO-PILOT WITH TWA

Your future is yours to command when you fly as a TWA co-pilot. You'll be flying the world's finest equipment with the world's finest airline.

JUST LOOK AT THESE ADVANTAGES — starting salary of $400 from first day of training; beginning with the third year, co-pilots receive monthly base pay and guarantee of 60 hours of flight pay; annual sick leave; paid vacation; liberal free transportation for you and your family each year; retirement plan; group insurance and many more.

QUALIFICATIONS: Aged 22 to 30; between 5'8" and 6'2"; can pass TWA physical. Must have: 400 hours total pilot time; CAA Commercial Certificate and sufficient instrument time to qualify for Instrument Rating. Two years of college or equivalent; Radio Telephone Permit Third Class

There's a wonderful future waiting for you with TWA. Get your letter off today to: Mr. R. Paul Day, Employment Manager.

TRANS WORLD AIRLINES
MUNICIPAL AIRPORT
KANSAS CITY, MO.

GAMBLE?

sure . . . if the odds are in YOUR favor . . .

DECISION/INC—nationwide specialists in recruitment of engineering personnel—have an active and enviable record in developing job opportunities for men who want bigger salaries and a chance for greater personal achievement.

DECISION/INC is retained by more top-ranking firms thruout the nation than any other organization to *find the right man* for each job. This confidential service costs you nothing.

It takes TIME—MONEY—EFFORT to improve your job situation. If you are an engineer or scientist, particularly in the ELECTRONIC—AERO-NAUTICAL or GUIDED-MISSILE field, DECISION/INC will do this **quickly, effectively at no cost to you.**

HOW? Our placement specialist develops a plan "tailor-made" for you —which includes a resume of your experience . . . and then a review by selected companies leading to confidential interviews at **your** convenience and **our** client's expense.

NOW is the time for DECISION!
All **you** do **Now** is . . . send us your name, home address, job interest or title. We take it from there.

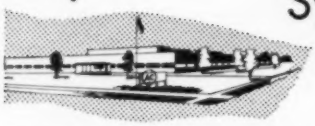
Write or phone:
OLIVER P. BARDES,
President—
DECISION/INC
1460-7E FIRST NATIONAL BANK BLDG.
CINCINNATI 2, OHIO
GArfield 1-1700

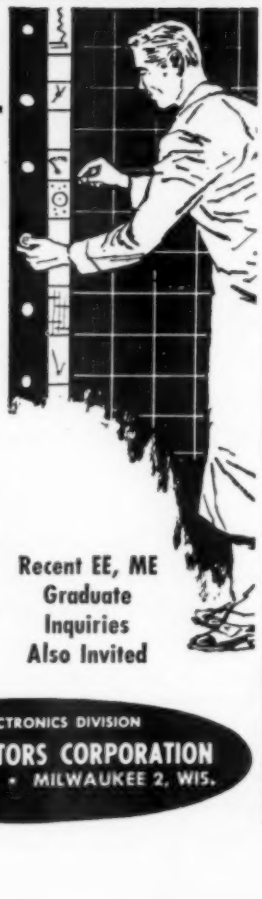
Publishers of the authoritative Engineers' Job Directory

Servo Engineers

ELECTRICAL MECHANICAL

Inertial Guidance System Program





Enjoy Challenging Opportunities in the further development and systems testing of Inertial Guidance Systems and their Servo Loops in the most versatile laboratories in the country.

Work with the top men in the field and with the finest test, research and development facilities. New plant being added in suburban Milwaukee as a part of Major, Permanent, Expansion Program.

AC will provide financial assistance towards your Master's Degree. A Graduate Program is available evenings at the University of Wisconsin, Milwaukee.

GM's long-standing policy of decentralization creates individual opportunity and recognition for each Engineer hired.

Milwaukee offers ideal family living combining small town hospitality with every metropolitan shopping and cultural advantage.

For personal, confidential interview in your locality send complete resume to

Mr. John F. Heffinger
Supervisor of Salaried Personnel

Recent EE, ME Graduate Inquiries Also Invited

AC

THE ELECTRONICS DIVISION
GENERAL MOTORS CORPORATION
FLINT 2, MICH. • MILWAUKEE 2, WIS.

ENGINEER, ME AE

AERO-THERMODYNAMIC DEVELOPMENT

on Nuclear Aircraft Engines Units

The application of nuclear energy to aircraft flight requires the pooling of many contributory talents. General Electric's ANP Department encourages the growth of such talents by offering the qualified engineer a work-environment that frees his creativeness while increasing his value. Qualifications include 2 to 6 years experience in thermodynamics and aerodynamic development. Work involves thermodynamic and fluid flow aspects of turbine type aircraft engines and components.

Openings at Cincinnati, Ohio and Idaho Falls, Idaho

Address replies, stating salary requirements, to location you prefer

J. R. Rosselot
G. E. Co.
P. O. Box 132
Cincinnati, O.

L. A. Munther
G. E. Co.
P. O. Box 535
Idaho Falls, Idaho

GENERAL ELECTRIC

UNUSUAL OPPORTUNITIES
can be found each week in the
EMPLOYMENT SECTION OF
AVIATION WEEK

He makes a daily trip to tomorrow

This man is a creative engineer. Like other young men, he is interested in baseball, talks about taxes, is proud of his kids. But there's something different about this *particular* young man. He's a Goodyear Aircraft engineer. And, each day when he passes through this door, he leaves behind the world known to his friends and neighbors and crosses the threshold of tomorrow.

Of course "tomorrow" is not new to aviation engineers. For the whole industry is on the threshold of spectacular things to come. But, here again, there's something different about this *particular* door. Behind it lie many unique and exciting avenues of endeavor—airships, electronics, plastics, missiles, structures and many more—examples of diversification rarely found under one roof. And *this man,* like all Goodyear Aircraft engineers, guides himself along his chosen path utilizing the most modern facilities available to put his own ideas to work.

For here individual thought and expression are encouraged. Ideas are a prime commodity and every one gets a chance to mature. Here engineers, in transforming their own ideas into practical realities, find the stimulation of creative challenge and the satisfaction of realistic accomplishment.

If you are a creative engineer with faith in your ideas and confidence in your ability to make them work, there's a challenging career waiting for *you* at Goodyear Aircraft. Our growth and diversification demand expansion of our engineering staffs at both Akron, Ohio, and Litchfield Park, Arizona. Opportunities are unlimited for creative engineers in all specialties.

Salaries and benefits are, of course, liberal. And if you wish to continue your academic studies, company-paid tuition courses leading to advanced degrees are available at nearby colleges.

For further information on *your* career opportunities at Goodyear Aircraft, write: Mr. C. G. Jones, Personnel Dept., Goodyear Aircraft Corporation, Akron 15, Ohio.

They're doing big things at

GOODYEAR AIRCRAFT

THE TEAM TO TEAM WITH in AERONAUTICS

CHIEF PILOT

Flight Laboratory-Airborne Electronics

LEADER in aviation electronics located near Greater Philadelphia has immediate opening for supervisory pilot. Position requires experience as supervisor of flight test operation, plus 5 or more years as an experimental test pilot on commercial and military aircraft, including jet and 4 engine. Experience in flight testing electronic equipment and full pilot ratings necessary. Engineering degree preferred.

Replies confidential, send resume to

P-3227 Aviation Week
Class. Adv. Div. P.O. Box 12, N. Y. 36, N. Y.

Engineers, Scientists, Designers

Outstanding Opportunities Available

The types of work on which you could be engaged include:

Missiles
Applied Mechanics
Geophysics
Underwater Ordnance
Electronic Countermeasures
Digital & Analog Computers
Instruments and Controls
Solid State Physics
Microwaves & Antennas
Infra Red Systems
Inertial Systems
Servomechanisms
Balloon Systems
Industrial Automation
Upper Atmosphere Research
Fine Particle Technology
Surface Chemistry
Optics
Mechanical Design
Airborne Early Warning
Radar Systems
Information Theory

Systems Analysis and Design

Electronic Equipment design and Miniaturization

You can grow with our dynamic and progressive research and development activity in its long-term expansion. We are prime systems contractor for several major programs in which new groups are being formed and which create ground floor opportunities for you. We have excellent facilities and equipment and can use people to the fullest extent of their capacity, with encouragement and opportunity to advance further. You can work closely with prominent engineers and scientists. Our managerial positions are staffed by people with technical engineering backgrounds. You do not become isolated on a small part or component but contribute to and become an integral part of a significant program. Congenial associates and atmosphere. Our people tell us they enjoy their work, and our extremely low turnover rate testifies to this. Tuition re-imbursement plan includes University of Minnesota three minutes away. Delightful residential communities close to work, fine cultural environment, recreational areas, fishing, hunting, boating winter and summer sports. Live in the Land of Sky Blue Waters. Permanent security with a stable, long-established company whose motto is "The Future is Our Frontier." Salaries recognize experience for all levels of positions. Relocation expenses.

We believe we have all the opportunities you could find anywhere in the country.

Engineers—Electronic, Electrical, Aeronautical, Mechanical, Chemical

Physicists, Meteorologists, Physical and Electro **Chemists**

Junior, Associate, and **Senior** grades, from Bachelor through Doctorate degrees.

All inquiries will be treated in complete confidence.

You are invited to address
PETER BURGESS, Director of Personnel,

MECHANICAL DIVISION OF General Mills
1630 Central Ave. N.E., Minneapolis 13, Minnesota

If unavailable for interview, fill in blank and mail to Director of Personnel at above address for brochure outlining our work and openings.

Name_____
Street & No._____
City_____ State_____ Zone_____

REPLIES (Box No.): Address to office nearest you c/o This publication Classified Adv. Div.
NEW YORK: P. O. Box 12 (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)
LOS ANGELES: 1125 W. 6th St. (17)

SELLING OPPORTUNITY OFFERED

The Stillman Rubber Company of Culver City, Calif., manufacturers of Military approved "O" Rings as well as custom-molded and extruded rubber items, seeks capable sales representation in Georgia and Alabama. Applications are invited from supply companies seeking franchised distributorships and manufacturers agents working with aviation activities in the prescribed areas. Please address inquiries to George W. Van Cleve, Vice-President-Sales, Stillman Rubber Company, Culver City, Calif.

POSITIONS WANTED

Pilot ATR written, all land ratings. 5500 hrs. diversified flying, extensive IFR, 3500 Multi-Eng., incl. Twin-Beech., B-25, C-46; 2400, hrs. DC-3, 2½ yrs. sched. airline, 4 yrs. college engrg. Age 36 family. Desire permanency. Resume on request. PW-3401, Aviation Week.

Field Service: 19 yrs. diversified aircraft experience including 10 yrs. field service jet and conventional powerplants; widely travelled foreign, domestic, USAF and commercial airline contacts; excellent correspondent; commercial pilot; college. Seeks position greater responsibility and growth potential, preferably field service administration and supervision. PW-3374, Aviation Week.

Dayton Representative Available—Ten years experience obtaining Air Force contracts. PW-3470, Aviation Week.

Pilot-Engineer-Mechanic. 4000 hours. ATR. Engineering Degree, helicopter experience, speak Spanish, interested in position as pilot or sales representative for well-established U. S. company in Central or South America. Will consider all offers any location. Available Dec. 1st. R. N. Elliott, 919 N. Winnetka Dallas 8, Texas.

Administrative Secretary-Office Manager-Superior skills, personable, 16 yrs. exp. aircraft parts manufacture. PW-3455, Aviation Week.

Experienced pilot, age 32, family 5700 hours, ATR, SMEL, type DC-3 4½ years airline experience, speaks Spanish, education in engineering, practical experience in contracting. Position with sound future will relocate any place. PW-3338, Aviation Week.

SELLING OPPORTUNITY WANTED

Manufacturers Agent twenty years as engineer and sales manager in aircraft and automotive fields wants new lines for aircraft, missile and industrial accounts in Ohio and Michigan. RA-3263, Aviation Week.

Mr. Promotable Engineer

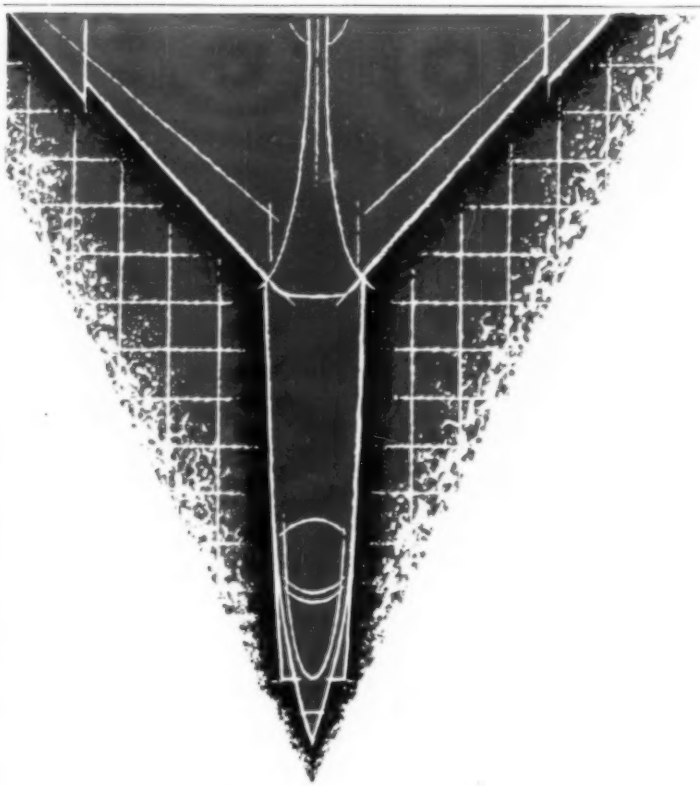
TO $10,000

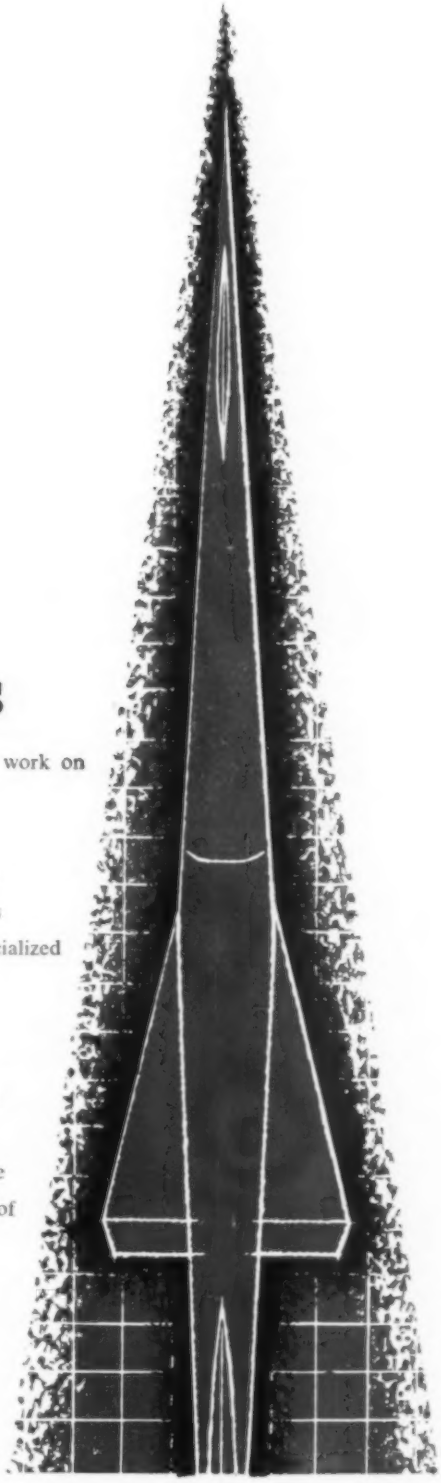
We need a couple of junior engineers ready for heavy responsibilities. We are expanding in electronics, need top talent and pay top prices.

Write in confidence to:

P-3485, Aviation Week
Classified Adv. Dept., P.O. Box 12
New York 36, N. Y.

ANYTHING within reason that is wanted in the field served by Aviation Week, can be quickly located through bringing it to the attention of thousands of men whose interest is assured because this is the business paper they read.





DESIGN ENGINEERS

Perhaps you are wondering which way to turn for real pioneering work on a complete aerial weapon. The missile field offers you a role in advancing our newest family of weapons. Fighter aircraft offer an increasing challenge in human engineering as we equip pilots for new speed and space conquests. In both fields, unique attractions for imaginative designers abound. Yet seldom in today's ultraspecialized organizations is the designer privileged to contribute to *both* fighter and missile development. An exception is Chance Vought's integrated missile and fighter design organization. Here's a rare opportunity to experience the varied career advantages of piloted and pilotless weapons, and to apply applicable design lessons of one field to the other. There may be a place for you with the developers of the Regulus missile and Crusader fighter. Send a resume of your background to:

Mr. J. W. Larson, Asst. Chief Engineer
Dept. 11-3A Engineering Personnel

CHANCE VOUGHT AIRCRAFT
INCORPORATED · DALLAS, TEXAS

WANTED: TODAY'S ENGINEERS FOR THE POWER PLANTS OF TOMORROW

Continental J69 Turbo Jet Engine

To implement Continental Aviation and Engineering Corporation's job—research and engineering aimed at producing the power plants of the future—a program of expansion is under way. The company has openings for qualified engineers interested in permanent jobs with excellent opportunity for advancement. Working and living conditions are exceptionally fine. The CAE facilities are among the most modern and well-equipped; the recreational, educational and cultural advantages of the Detroit area are second to none.

IF YOU WOULD LIKE TO KNOW MORE about a career at CAE, write for this illustrated brochure outlining the company's role in research and engineering, and suggesting YOUR place in this organization.

ADDRESS: "SALARIED PERSONNEL"

CONTINENTAL AVIATION and ENGINEERING Corporation

12700 KERCHEVAL AVENUE
DETROIT 15, MICHIGAN

SUBSIDIARY OF CONTINENTAL MOTORS CORPORATION

ENGINEERS:

- *air-borne system engineers*
- *project engineers on small rotating equipment*
- *instrument designers*

Work with a recognized industry leader . . . expanding Avionic Division creates opportunities . . . complete engineering, laboratory and production facilities.

We need men who want to get ahead on their own merits . . . who are willing to do a job . . . and be rewarded accordingly.

You'll like Racine . . . our plant overlooks beautiful Lake Michigan . . . it's just one hour to Chicago . . . and convenient to Wisconsin's famous North Woods lakes and resorts.

Let's get acquainted. You are invited to write the Director of Industrial Relations today. All communications are strictly confidential.

John Oster MANUFACTURING CO.
avionic division
RACINE, WISCONSIN

RADIO AND ELECTRICAL SYSTEMS INSTALLATION ENGINEER

Familiar with low voltage DC aircraft equipment such as generators, starters, regulators, navigation and communication systems, and their installation. Experience in custom installations of such equipment on a variety of executive aircraft desirable.

Contact
Personnel Dept.
PIPER AIRCRAFT CORPORATION
LOCK HAVEN, PA.
Phone Lock Haven 6711
Ext. 259

STRESS ENGINEERS DYNAMICISTS

EXCELLENT OPPORTUNITIES
with
ESTABLISHED FIRM IN HELICOPTER INDUSTRY

SALARY OPEN

CALL OR WRITE

PREWITT AIRCRAFT COMPANY
E. MADISON & HOLLY AVES.
CLIFTON HEIGHTS, PA.
MADISON 6-6500

MANAGER OF MARKETING ELECTRONICS

A major fully-integrated division of a large, nationally known corporation offers an excellent opportunity for an outstanding man with extensive experience in directing multi-million dollar sales programs involving both government and industrial electronics products.

The sales department is backed by excellent engineering and manufacturing facilities and by an outstanding name in the trade.

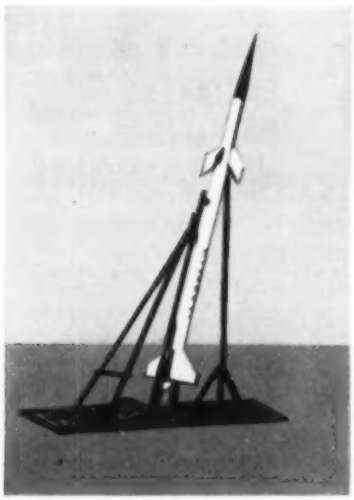
High level sales and administrative experience and a practical knowledge of electronics are essential. Replies will be held confidential.

P-3476, Aviation Week
520 N. Michigan Ave., Chicago 11, Ill.

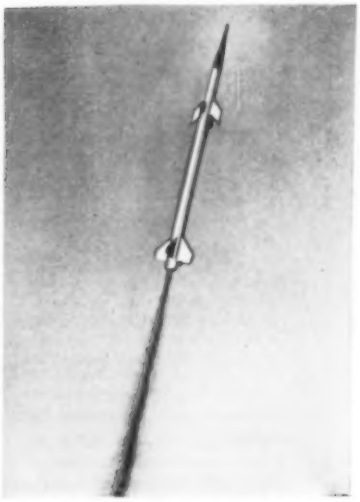
Don't forget
THE BOX NUMBER

when answering the classified advertisements in this magazine. It's our only means of identifying the advertisement you are answering.

It takes only a few men to set up the Terrapin for firing virtually any place. No special equipment is needed.



Telemetering equipment will reveal hitherto unrecorded secrets of the upper atmosphere with the inexpensive, easily handled Terrapin.



The two-stage Terrapin rises 10,000 feet, drops its first stage, and continues 78 miles more into the ionosphere.

REPUBLIC'S INEXPENSIVE PORTABLE TERRAPIN ROCKET PROBES IONOSPHERE SECRETS

BUILDING A LIGHTWEIGHT RESEARCH VEHICLE for high-altitude probing requires engineering teamwork and individual ingenuity ... especially when complete power plant, airframe and telemetering equipment must be contained in a missile 15-feet long and 6½ inches in diameter.

REPUBLIC DID IT, with complete success on the first test launching, by bringing together all the essential engineering skills ... in a working atmosphere conducive to high productivity ... our past achievements the foundations for new and varied work assignments.

AS A MEMBER of the Guided Missiles Division you will work on projects designed to meet requirements of the future.

NEW CONCEPTS, methods and designs provide future personal expansion in a company which has grown 10-fold in only four years ... where salaries are tops for industry.

LIVE AND WORK in Metropolitan New York — Long Island — famous for homes, shopping, culture, education and recreation.

ENJOY the Republic benefits: 2-part retirement plan, education with ⅔ of tuition company-paid, and free Life, Accident, Health, Surgical and Medical expense benefits for you and your entire family.

Please send resume to:
MR. A. R. MULLIGAN
Technical Placement

Guided Missiles Division

REPUBLIC AVIATION

223 Jericho Turnpike *Mineola, New York*

SENIOR ENGINEERS PHYSICISTS MATHEMATICIANS

are invited to investigate challenging and creative work on
ADVANCED WEAPON SYSTEMS
ADVANCED TARGET SYSTEMS
in the recently organized Advanced Development Division of

RADIOPLANE COMPANY

Engineers with experience in Electronic and Electro-mechanical systems analysis, design and development; Aeronautical Engineers with preliminary design experience; Electronics Engineers with microwave electronics and electronic countermeasures experience;

Physicists who have worked in operations analysis, microwave electronics and radio frequency propagation phenomena;

Mathematicians who have experience in operations analysis and in digital computer problem analysis.

We are endeavoring to staff a number of senior engineering and scientific positions. We place a premium on training and experience.

Send complete resumes to:
Personnel Mgr., A-1
Radioplane Company
8000 Woodley Avenue
Van Nuys, California

TWO "ROYAL" OPPORTUNITIES WITH ROYAL AIRCRAFT, PRODUCERS OF AMERICA'S ONLY ALL NEW FIVE-PLACE TWIN ENGINE AMPHIBIAN, "ROYAL GULL"

Royal Aircraft Needs SALES EXECUTIVES

Extensive expansion program makes it necessary for us to add two high caliber sales executives to our staff.

• VICE PRESIDENT — SALES

Top-Level management background necessary to organize and direct extensive sales program. Aircraft background preferred.

• REGIONAL SALES MANAGER

Must have considerable experience in organizing and supervising distributor operations. Current pilot rating desirable. Must be free to travel.

If you can meet these requirements and are interested in a real challenge, send your resume and a recent photo to

MAX I. BLACK

Royal Aircraft Corp.
(Subsidiary of Kearney & Trecker Corp.)

6784 W. National Avenue
Milwaukee 14, Wisconsin

FLUTTER and VIBRATION GROUP ENGINEER

To be responsible for flutter and vibration control of high speed airplane weapons system. Requires a working knowledge of theoretical flutter analysis of high speed aircraft, flight flutter testing, flutter model testing, and vibration theory and testing.

Send resume to:

RAYMOND F. KALETTA
Technical Placement Supervisor
P. O. Box 516
St. Louis 3, Missouri

McDONNELL AIRCRAFT CORPORATION

Liaison Engineer FOR Microwave Systems

Opportunity with Light Military Electronic Equipment Department of General Electric.

Capable of directing and coordinating the design and development of microwave projects on military airborne electronic systems.

salary to $11,000
commensurate with experience

Reply in confidence to:
Mr. John Sternberg, Dept. S64
Light Military Electronic Equipment Dept.

GENERAL ELECTRIC
French Road, Utica, N. Y.

HELICOPTER PILOTS & MECHANICS JOB OPPORTUNITIES AVAILABLE

Bell 47
Sikorsky S-55
Sikorsky S-58

ROTOR-AIDS, INC.
P. O. Box 1850 Ventura, California

NEW ADVERTISEMENTS

Received by Nov. 23 will appear in the Dec. 3 issue subject to limitations of space available.

CLASSIFIED ADVERTISING DIVISION
AVIATION WEEK
BOX 12 NEW YORK 36, N. Y.

FOR RATES OR INFORMATION About Classified Advertising

Contact The McGraw-Hill Office Nearest You.

ATLANTA, 3
1321 Rhodes-Haverty Bldg.
WAlnut 5778
R. POWELL

BOSTON, 16
350 Park Square
HUbbard 2-7160
H. J. SWEGER, Jr.

CHICAGO, 11
520 No. Michigan Ave.
MOhawk 4-5800
W. HIGGINS
J. BRENNAN

CINCINNATI, 37
1825 Yorktown Rd.
Swifton Village, Apt. 2
REdwood 1-3238
G. MILLER

CLEVELAND, 15
1510 Hanna Bldg.
SUperior 1-7000
W. SULLIVAN

DALLAS, 2
Adolphus Tower
Main & Akard Sts.
Riverside 7-5064
D. BILLIAN

DETROIT, 26
856 Penobscot Bldg.
WOodward 2-1793
W. STONE

LOS ANGELES, 17
1125 W. 6 St.
MAdison 6-9351
C. McREYNOLDS
D. BRENNAN
D. McMILLAN

NEW YORK, 36
330 West 42 St.
LOngacre 4-3000
R. LAWLESS
S. HENRY
D. COSTER
R. HATHAWAY

PHILADELPHIA, 3
17th & Sansom St.
Rittenhouse 6-0670
H. BOZARTH
E. MINGLE

SAN FRANCISCO, 4
68 Post St.
DOuglas 2-4600
W. WOOLSTON

KAISER ALUMINUM

Fastest growing fully integrated producer of aluminum has excellent opportunity for:

HEAVY PRESS SPECIALISTS

Position: To provide a liaison service of high specialization and quality in connection with the technical phases of aluminum extrusion heavy press sales program. To provide technical advice to customers, mainly in the aircraft and military fields, and also to cover potential commercial applications. Coordinate sales efforts with mill extrusion facilities.

Qualifications: Must have experience in the aircraft or heavy industry field as a production design engineer. Knowledge of hard alloy aluminum extrusion process essential. Requires engineering degree or its equivalent in experience. Must be able to advise customers and salesmen.

Location: East and West Coast — Salary commensurate with experience

Please reply in full, stating age, education, background, and experience to:

PERSONNEL PROCUREMENT

KAISER ALUMINUM & CHEMICAL SALES, INC.

919 No. Michigan Avenue — Chicago 11, Illinois

SPECIAL SERVICES

SEARCHLIGHT SECTION

(Classified Advertising)

BUSINESS OPPORTUNITIES — EQUIPMENT - USED or RESALE

OXYGEN EQUIPMENT
SALES & SERVICE
REGULATORS — MASKS — VALVES
PORTABLES & CYLINDERS
FIXED INSTALLATIONS
GOV'T. APPROVED REPAIR STATION
ZEP AERO Phone: ORegon 8-1161 EL SEGUNDO, CALIFORNIA

CARTER AVIATION
Byrd Airport, Richmond, Va.
C.A.A. Approved Repair Station No. 4260
Class 1 & 3 Airframe No Limitations
Power Plant Limited
AERO-COMMANDER SPECIALIZED SERVICE
By appointment only
P. O. Box 6097 — Ph. Fairfield 4670

IF YOU RENDER A SERVICE TO THE AVIATION INDUSTRY YOU SHOULD INQUIRE ABOUT THIS SECTION!
Write
Classified Advertising Division
330 W. 42 St., New York 36, N. Y.

WORLD'S FOREMOST
LODESTAR
SERVICE CENTER

Inspection	Radar
Maintenance	Interiors
Instrumentation	Engine Change
Modification	Exteriors
Overhaul	Radio

LEAR
AIRCRAFT ENGINEERING DIVISION
Santa Monica Airport, Santa Monica, California
Builders of the Incomparable Learstars

7 TO 10 DAYS' INSTALLATION
Bendix Collins R.C.A. **RADAR** X-Band or C-Band
CORRECT RADOMES for X or C BAND

Only R/W has the reinforced double-shell dielectric radome recommended for X-Band —high transmission efficiency and high structural strength with *no compromise* or loss— *no restrictions* of air speed or any kind. Weather-tight fitting, leakproof, quiet. Won't vibrate loose. Lowest installation cost.

Separately hinged radome and scanner, for easy disconnect and adjusting—*necessary for accurate antenna tuning.* Quick access to instrument panel.

Remmert-Werner
Inc. of St. Louis — Lambert Field
Inc. of Florida — Pompano Beach
Inc. of Toledo — Express Airport
Lodestar DC3 Beech
Specialists in Conversion Maintenance Overhaul

Deal Directly with Owner

No deposit required—no long-term contract.

- Executive appointments
- Well equipped radio
- Full Instrumentation
- Good selection

C18 and D18 BEECHCRAFT
FOR LEASE

$800 monthly and up. Fly all you like. Aircraft hull insurance included. If desired aircraft available for outright purchase

TRADE-AYER COMPANY
Linden Airport — Linden, N. J.
Hunter 6-7690

TWO DC-4's FOR LEASE
ONE CARGO
ONE PASSENGER
FR-3373, Aviation Week
Class. Adv. Div., P.O. Box 12, N.Y. 36, N.Y.

DC-3
FOR LEASE
Standard Airline Radio
21-Passenger interior
Complete Anti-icing, De-icing
TRANS-INTERNATIONAL AIRLINES, INC.
P. O. Box 233, Miami 48, Fla.

another exclusive offering!

24-Passenger Airline C-47's

Available for Immediate Sale
Delivery Early November
In Foreign Scheduled Airline Operation
Price asking $110,000
"F.A.F. Location"
In excellent Condition

For details contact:

William C. Wold Associates
(Exclusive Sales Agents)
551 Fifth Avenue, New York 17, N. Y.
Telephone: MUrray Hill 7-2050
Cable: BILLWOLD, N. Y.

F 51-D MUSTANGS

North American Fighter Planes
8 available

These aircrafts available immediately and ready to go. *Sell, trade or lease*

STINSON FIELD AIRCRAFT
P. O. Box 1738 San Antonio, Texas
CApital 4-8434

GRUMMAN MALLARD J-29
Now being overhauled
Will finish to specifications

1946 BEECHCRAFT D-185
Clean & ready to go—$34,750

WILLIAM C. WOLD ASSOCIATES
Dept. AW-551 Fifth Ave., N.Y. 17, N.Y.
Telephone: MUrray Hill 7-2050—Cable: Billwold

Immediate Delivery
We stock, overhaul, and install

PRATT & WHITNEY	WRIGHT
R1830 –75, –92, –94	**R1820** –202, –56, –72

R985 R1340 R2000
and our most popular DC3 engine
R1830 - SUPER - 92

ENGINE WORKS
Lambert Field Inc. St. Louis, Mo.

DC-3 FOR SALE

We are owners.

LEEWARD AERONAUTICAL SALES, INC
P.O. BOX 233, MIAMI 48, FLA.

HELICOPTER
Hiller—Model UH-12B, Very low airframe and engine time.
Perfect Condition.
EAST COAST AVIATION CORPORATION
Bedford Airport Lexington 73, Mass.

---

keep your weather eye out for
Weather Eye
smaller lighter **Flight RADAR**
custom fitted to your plane
P. O. Box, Bridgeton, Mo.

RAS INCORPORATED
"Take a Heading for Reading"
for the BEST MAINTENANCE • OVERHAUL • MODIFICATION • INSTALLATION
READING AVIATION SERVICE, INC.
Municipal Airport Phone 3-5253 Reading, Pennsylvania

SINCE 1937 *Page* AIRWAYS, Inc.
FINEST AIRCRAFT MAINTENANCE
100 HR. INSPECTIONS
COMPLETE OVERHAUL
TWIN BEECH
DC-3
LODESTAR
ROCHESTER AIRPORT
PHONE GENESEE 7301 • ROCHESTER 11, N.Y.

FOR SALE

Three H5 Sikorski Helicopters with large inventory parts. Stinson Field Aircraft P. O. Box 1738 San Antonio, Texas. CApital 4-8434.

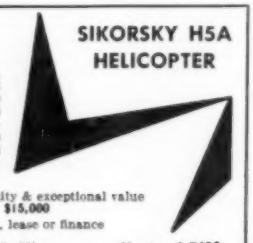
New Bell 47 D&G Helicopter parts, ½ off list. Stinson Field Aircraft P. O. Box 1738 San Antonio, Texas. CApital 4-8434.

C-125 Northrop Trimotor Plane, excellent condition, low time. Sell or trade. Stinson Field Aircraft P. O. Box 1738 San Antonio, Texas. CApital 4-8434.

F-51-D North American Fighter Planes, limited quantity, low time, excellent condition, ready to go. Sell trade or lease. Stinson Field Aircraft P. O. Box 1738 San Antonio, Texas. CApital 4-8434.

Deal Directly with owner
Early Model 851, excellent useful load, pilot, one hours fuel & 965 lbs. All modifications. Total time on airframe and P&W R985 engine 299 hours.

SIKORSKY H5A HELICOPTER



Rare opportunity & exceptional value
$15,000
will sell, lease or finance
A. J. Ming *Hunter 6-7690*
TRADE-AYER COMPANY
Linden Airport, Linden, N. J.

NAVCO, inc. Lambert Field St. Louis, Mo. PErshing 1-1710
has factory fresh, dated
DEICER BOOTS
DC3 Lodestar Beech

F 51-D
North American Fighter Planes, limited quantity
Sell, trade or lease
STINSON FIELD AIRCRAFT
P. O. Box 1738 San Antonio, Texas
CApital 4-8434

PROFESSIONAL SERVICES

KIRBY AND COPE ASSOCIATES
HUMAN FACTORS
Consultation on the design and utilization of mechanical and electrical equipment to suit man's physiological and psychological capabilities. Specialists in the cross-application of physical science and engineering with biology, medicine and psychology.
1515 Rambiewood Road Baltimore 12, Md.
Tel. ID 3-3609 or PE 2-8839

Consult these Specialists

when you need professional assistance in solving difficult problems. Their specialized knowledge and broad experience can prove invaluable in saving both time and money for you.

FLY FRIENDSHIP AIRPORT
TO WASHINGTON—BALTIMORE
40 min. to Wash.—20 min. to Balto.
Complete facilities—no waiting

Contact us for car, limo, & hotel reservations.
PAN-MARYLAND AIRWAYS, INC.
Friendship Airport, Md.
CAA certified repair station

ADVERTISERS IN THIS ISSUE

AVIATION WEEK, NOVEMBER 19, 1956

ADEL PRECISION PRODUCTS, DIV. OF GENERAL METALS CORP. 14
Agency—The McCarty Company
AERO DESIGN & ENGINEERING COMPANY 124
Agency—Tom P. Gordon Co., Adv.
AIRCRAFT RADIO CORPORATION 6
Agency—Burke Dowling Adams, Inc.
AIR FRANCE 46
Agency—Buchanan & Company, Inc.
AIRWORK CORPORATION 78
Agency—Gene Wyble Advertising
ALL AMERICAN ENGINEERING CO. 4
Agency—Gaynor, Colman, Prentis & Varley, Inc.
AMERICAN MACHINE FOUNDRY CO., DEFENSE PRODUCTS GROUP 84
Agency—Fletcher D. Richards, Inc.
APPLIED SCIENCE CORP. OF PRINCETON 95
Agency—Paul M. Healy Adv. Service
ARMA DIVISION, AMERICAN BOSCH ARMA CORP. 80, 81
Agency—Doyle, Kitchen & McCormick, Inc.
AUTONETICS, A DIV. OF NORTH AMERICAN AVIATION, INC. 130
Agency—Batten, Barton, Durstine & Osborn, Inc.
AVNET ELECTRONICS 110
Agency—Dale and Finkels, Inc.
AVIATION WEEK 136, 137
AVRO AIRCRAFT LIMITED 122, 123
Agency—Cockfield, Brown & Co. Ltd.
BABCOCK & WILCOX COMPANY 100
Agency—O. S. Tyson & Co.
B & H INSTRUMENT CO., INC. 128
Agency—The Kotula Company
BASCH COMPANY, GEORGE 85
Agency—Davis, Parsons & Strohmeier, Inc.
BOURNS LABORATORIES, INC. 57
Agency—Allen, Dorsey & Hatfield, Inc.
CHANCE VOUGHT AIRCRAFT, INC. 79
Agency—Ruthrauff & Ryan, Inc.
CHICAGO AERIAL INDUSTRIES, INC. 91
Agency—Leonard Advertising
CLEVELAND PNEUMATIC TOOL COMPANY 72
Agency—Meldrum & Fewsmith, Inc.
COLOR TELEVISION, INC. 157
Agency—Sturges & Associates
COLUMBUS DIV. OF NORTH AMERICAN AVIATION, INC. 113
Agency—Batten, Barton, Durstine & Osborn, Inc.
CONVAIR A DIV. OF GENERAL DYNAMICS CORP. (SAN DIEGO) ..... Second Cover
Agency—Buchanan & Co., Inc.
CONVAIR A DIV. OF GENERAL DYNAMICS CORP. (POMONA) 140
Agency—Pacific Western Adv. Agency
DELAVAN MANUFACTURING CO. 109
Agency—Fairall & Company
DOUGLAS AIRCRAFT CO., INC. 118
Agency—J. Walter Thompson Co.
DOW CHEMICAL COMPANY FOUNDRY SALES 86
Agency—MacManus, John & Adams, Inc.
DOW CORNING CORPORATION 16
Agency—Church & Guisewite, Adv., Inc.
EASTMAN KODAK CO., X-RAY DIVISION 93
Agency—J. Walter Thompson Co.
ECLIPSE-PIONEER DIV., BENDIX AVIATION CORP. 105
Agency—MacManus, John & Adams, Inc.
EDO CORPORATION 104
Agency—Davis, Parsons & Strohmeier, Inc.
ELASTIC STOP NUT CORP. OF AMERICA ..... Fourth Cover
Agency—G. M. Basford Company
ELECTRICAL ENGINEERING & MFG. CORP. 37
Agency—West-Marquis, Inc.
ELECTRO-SNAP SWITCH & MFG. CORP. 60-61
Agency—Stoetzel & Associates, Inc.
ESSO STANDARD OIL CO. 106
Agency—McCann-Erickson, Inc.
FAIRCHILD ENGINE & AIRPLANE CORP., AIRCRAFT DIV. 3, 119
Agency—Gaynor, Colman, Prentis & Varley, Inc.
FAULTLESS CASTER CORPORATION 142
Agency—Perrin-Paul Co. Adv.
FINN & CO., T. R., ELECTRONICS DIV. 78
Agency—Feeley Advertising Agency
GARRETT CORP., AIRESEARCH MFG. DIV. 134, 135
Agency—J. Walter Thompson Co.
GENERAL ELECTRIC COMPANY 10, 11, 18, 132
Agency—G. M. Basford Company
GENERAL ELECTRIC CO. (ELECTRONICS COMPONENTS DIV.) 26
Agency—Mayon, Inc.
GENERAL ELECTRIC CO. (MISSILES & ORDNANCE SYSTEMS DEPT.) 71
Agency—Deutsch & Shea, Inc.
GENERAL MILLS, INC. (MECHANICAL DIV.) 98
Agency—Knox Reeves Adv., Inc.
GIANNINI & CO., INC., G. M. 78
Agency—Grant Advertising, Inc.
GOODRICH CO., THE B. F., AVIATION PRODUCTS DIV. 22
Agency—Batten, Barton, Durstine & Osborn, Inc.
GULF OIL CORPORATION 48
Agency—Young & Rubicam, Inc.
HAMILTON STANDARD DIV., UNITED AIRCRAFT CORP. 20
Agency—Lennen & Newell, Inc.
HARRISON RADIATOR DIV., GENERAL MOTORS CORP. 57
Agency—D. P. Brother & Co., Adv.
HARTWELL AVIATION SUPPLY CO. 58
Agency—The McCarty Company
HEWLETT-PACKARD COMPANY 96
Agency—L. C. Cole Co., Inc.
HOLLEY-CARBURETOR CO. 15
Agency—Holden-Chapin-Laring, Inc.
HYATT BEARINGS DIV., GENERAL MOTORS CORP. 102
Agency—D. P. Brother & Company
INDIANA GEAR WORKS, INC. 141
Agency—Bozell & Jacobs, Inc.
JACK & HEINTZ, INC. 127
Agency—Fuller, Smith & Ross, Inc.
JOHNS-MANVILLE PRODUCTS 66
Agency—J. Walter Thompson Co.
KAMAN AIRCRAFT CORP., THE 82, 83
Agency—Charles Palm & Co., Inc.
KIDDE & CO., INC., WALTER 24
Agency—Cunningham & Walsh, Inc.
LITTON INDUSTRIES 70
Agency—Calkins & Holden, Inc.
LOCKHEED AIRCRAFT CORP., MISSILES SYSTEMS DIV. 54
Agency—Foote, Cone & Belding
LOCKHEED AIRCRAFT CORP. 138
Agency—Hal Stebbins Adv.
McCORMICK SELPH ASSOCIATES 67
Agency—Geith Pacific Adv. Agency
MICRO SWITCH DIV. OF MINNEAPOLIS-HONEYWELL REGULATOR CO. 90
Agency—Reincke, Meyer & Finn, Inc.
MINNEAPOLIS-HONEYWELL REGULATOR CO., AERONAUTICAL DIV. 74, 75
Agency—Foote, Cone & Belding
MOOG VALVE CO., INC. 56
Agency—Warman, Robins & Gorham, Inc.
NARMCO RESINS & COATINGS CO. 58
Agency—Riley-Nelson Company
NEW DEPARTURE DIV., GENERAL MOTORS CORP. 120
Agency—D. P. Brother & Co., Inc.
NORTHROP AIRCRAFT, INC. 38
Agency—West-Marquis, Inc.
PARKER AIRCRAFT COMPANY 139
PHILLIPS PETROLEUM CO., AVIATION DIV. 5
Agency—Lambert & Feasley, Inc.
RAMO WOOLDRIDGE CORP., THE 103
Agency—The McCarty Company
REEVES INSTRUMENT CORP. 101
Agency—The Edward W. Robotham Co.
RESISTOFLEX CORP. 114
Agency—Marschalk, Rickard, Gebhardt & Reed, Inc.
ROBINSON AVIATION, INC., AIRBORNE DIV. 55
Agency—Platt, Dyson & O'Donnell, Inc.
ROBINSON CO., RALPH C. 117
Agency—Chapin-Damm Adv.
ROHM & HAAS CO., PLASTICS DIVISION 17
Agency—Arndt, Preston, Chapin, Lamb & Keen, Inc.
ROHR AIRCRAFT CORPORATION 44, 116
Agency—Barnes Chase Company
RYAN AERONAUTICAL COMPANY 85
Agency—Batten, Barton, Durstine & Osborn, Inc.
RYERSON & SON, INC., JOSEPH T. 117
Agency—Calkins, Holden, Carlock, McClinton & Smith, Inc.
SAFE FLIGHT INSTRUMENT CORP. 62
Agency—Richard & Gunther, Inc.
SANBORN COMPANY 12
Agency—Culver Advertising, Inc.
SCIAKY BROS., INC. 108
Agency—Russell T. Gray, Inc.
SEARCHLIGHT SECTION ..... 143 to 156
SENSENICH CORP. 157
Agency—Foltz-Wessinger, Inc.
SOCONY-MOBIL OIL CO., INC. 13
Agency—Compton Advertising, Inc.
SOUTHWEST AIRMOTIVE CO. 92
Agency—Don L. Baxter, Inc.
SOUTHERN CALIFORNIA COOPERATIVE WIND TUNNEL 126
Agency—The Perrett Co.
SPERRY GYROSCOPE CO., DIV. OF SPERRY RAND CORP. ..... Third Cover
Agency—Roach, Yates & Matteson, Inc.
STEWART WARNER CORP. (ELECTRONICS DIV.) 94
Agency—The Buchen Company
TITANIUM METALS CORPORATION OF AMERICA 7
Agency—W. L. Towne Adv.
TORRINGTON CO., THE 68
Agency—Hazard Advertising Co., Inc.
TOWNSEND COMPANY, CHERRY RIVET DIV. 111
Agency—Bond & Starr, Inc.
TUBING SEAL CAP, INC. 107
Agency—R. H. Buss & Associates, Inc.
UNITED STATES RADIUM CORP. 95
Agency—Lethen Adv.
VICKERS, INC., DIV. OF SPERRY RAND CORP. 9
Agency—Witte & Burden Adv.
WEATHERHEAD COMPANY, THE, AVIATION DIV. 65
Agency—Chamberlin-Junk Adv., Inc.
WESTERN GEAR CORP. 8
Agency—Ruthrauff & Ryan, Inc.
WESTINGHOUSE ELECTRIC CORP., ELECTRONICS DIV. 86, 87
Agency—Fuller & Smith & Ross, Inc.
WESTINGHOUSE ELECTRIC CORP., BALTIMORE DIV. 112
Agency—H. W. Buddemeier Co.
WHITTAKER CO., LTD., W. R. 69
Agency—Mogge-Privett, Inc.
WICKES ENGINEERING & CONSTRUCTION CO. 103
Agency—The Roland G. F. Ullman Organization
ZENITH PLASTICS COMPANY 19
Agency—Francis D. Gonda Co.

CLASSIFIED ADVERTISING

F. J. Eberle, Business Mgr.

Bendix Aviation Corp. 145
Bendix Products Div. 143
Carter Aviation 155
Cessna Aircraft Co. 146
Chance Vought Aircraft 151
Continental Aviation Corp. 152
Decision, Inc. 148
East Coast Aviation Corp. 156
Engine Works 156
Friendship Airport 156
General Electric Co., West Lynn 154
General Mills Corp. 150
General Motors Corp. 147-8
Goodyear Aircraft Corp. 149
Kaiser Aluminum & Chemical Sales, Inc. 155
Kirby & Cope Associates 156
Lear, Inc 155
Leward Aeronautical Sales Inc. 156
McDonnell Aircraft Corp. 154
Navco, Inc. 156
Oster Manufacturing Co., John 152
Page Airways, Inc. 156
Piper Aircraft Corp. 152
Prewitt Aircraft Co. 152
Radioplane Co. 154
Reading Aviation Service Inc. 156
Remmert Werner, Inc. 155
Republic Aviation Corp. 153
Rotor-Aids, Inc. 154
Royal Aircraft Corp. 154
Solar Aircraft Co. 144
Stinson Field Aircraft 156
Trade-Ayer Co. 155-6
Trans-International Airlines, Inc. 155
Trans World Airlines 148
World Associates, Wm. C. 156
Zep-Aero 155

New
FIXED PITCH METAL
CAA approved up to 165 hp.
—
FIXED PITCH WOOD
CAA approved up to 225 hp.
—
TEST CLUBS
up to 3000 hp.
—
Get all the facts... write for Bulletins and Price Lists.

Dept. W, Sensenich Corp., Lancaster, Pa.

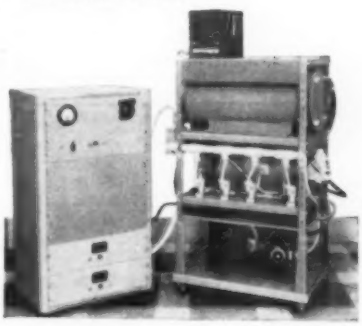
Sensenich PROP SHOP... Certified Repair Station for all makes fixed pitch metal or wood propellers ... Sensenich, Beech and Hartzell controllables. Magnaflux, etching, anodizing and plating service available. Service Hangar on Lancaster Municipal Airport. Approved Propeller Repair Station 3528. Unlimited Class 1 and 2 ratings.

AIRCRAFT SENSENICH PROPELLERS

Serving the Aircraft Industry for a Quarter of a Century

DYNAMIC ALTITUDE SIMULATOR

FOR TEST AND EVALUATION OF FLIGHT CONTROL EQUIPMENT AND INSTRUMENTS



Simulates actual altitude conditions of high performance aircraft or missiles in flight

Range — minus 1,000 to 80,000 ft
Max rate — 50,000 ft/min
Max response 10 cps

Write for Brochure

COLOR TELEVISION INCORPORATED

BELMONT 6, CALIFORNIA

LETTERS

Travel by Air

Your editorial in the Aug. 20 issue of AVIATION WEEK ("More Information Please," p. 21) reminded me of an article which I reprinted from the Journal of the American Medical Association. I thought you'd like to see the attached reprints which I have distributed here and there while making frequent commercial plane trips around the country.

Many of my colleagues agree with the points brought out in your editorial. Most of us have been highly irritated, at one time or another, by misleading information given on delayed flights. The airlines are in a particularly vulnerable position because the airports usually do not have the same public transportation system available to the railroads and bus terminals in downtown areas. Since a high percentage of air travelers are suburbanites, like myself, it is not only they but their families, who "chauffeur them" who are seriously inconvenienced. In my own case it has presented almost impossible situations, most of which could be prevented by frank and adequate communications or information service.

In this respect, the airlines are no worse than the railroads but we should expect more from the air lines. Keep up the good work.

A. M. BALTZER, Director
Small Business and Associations Program,
National Safety Council, Chicago 11, Ill.
(The letter referred to by Mr. Baltzer follows.—Ed)

To the Editor:—Having no cotton planted or wheat standing in the field, my only concern for the weather arises when I head for the airport. On my way to be one of the thousands of relaxed, carefree passengers who depart on time every month, I notice my increased interest in wind and rain. In fact, many other "limousine" riders become equally interested in the weather— so much so that the limousine (which bears a striking resemblance to a city bus, except it's easier to fall in the aisle and it's always dark) has iron bars to prevent the passengers' sticking their heads out the windows for a better view of the scattered clouds. After the bus goes over the flat plains for hours, making the usual number of detours off the highspeed highway, the airport comes into view, well placed in a short valley with a mountain at the end of each runway. The terminal is a large, comfortable, well-planned building that has been under construction since the end of World War II and is still unfinished. The limousine speeds on to a quonset hut, which faded signs proclaim as a temporary terminal. While waiting for the baggage to be scattered up and down the pavement, one cannot but admire a large red vehicle (i. e., "crash wagon") tactfully parked so that the only way to avoid inspecting it would be to feel your way past it with your eyes shut.

After being checked in by slender and striking young ladies who lift your 40 lb. bag effortlessly off the scale after you have taken both hands and a knee to get it off the floor, there is nothing to do but stand around and wipe the perspiration off your palms (and reduce your hernia). If you're a betting man, you may pause at the insurance vendor and casually take out a $62,500 insurance policy without a physical (with this policy and a little bad luck your heirs could start their own airline). As my wife jokingly says on every stormy day, "Take the maximum, dear." Finally, the flight is called right on time. Of course, this isn't the flight you were scheduled on; it was canceled three hours earlier.

I feel quite sure that other airline passengers do not share my anxiety, but they do relax in the most unusual ways. For instance, I was sitting by an experienced traveler (a gynecologist by trade) who "never" traveled any other way—I am sure of this because he explained it to me three times while attempting to push the buckle on his seat belt through the buckle on mine. Another type of experienced traveler is the "take off timer" (usually a surgeon). I have ridden with several who enjoyed this harmless game, and I find it quite habituating. After a few trips, the "timer" stares fixedly at his watch and in 25 seconds, or whatever the average takeoff time is, announces, "We're off." Usually they can come pretty close, particularly when you feel your neck suddenly shortened and no longer see the earth. However, my first attempt was a little premature; the captain "gave her the gun" and I watched my watch and in 25 seconds shouted, "We're in the air." The man next to me shook his head and said kindly, "Wait till he starts the other three motors."

On one occasion I had the pleasure to ride on the airplane in which the Wright brothers flew back from Kitty Hawk. You could hardly hear the motors—there was so much noise inside. Everything vibrated but the passengers. As usual, the fellow next to me fastened his seat belt and fell into a deep, untroubled slumber. It is amazing the way physicians can sleep on airplanes and never loosen their grip on the arm of the seat. Anyway, in a moment of relative quiet the lid on our ashtray got in phase with the motors and began vibrating quietly, like a jack-hammer breaking up concrete—my fellow passenger grabbed it so tightly, he crumpled the lid, though from all appearances he was still slumbering away.

The best seat on any airplane is not with the pilot, in the lavatory, or on the stewardess' lap, but just ahead of two persons who converse as follows:

"Say, did you read about that plane crash the other day?"

"No, what about it?"

"That was the damndest thing, same kind of plane as this, just flying along, not a cloud in sight and 'bang.' "

In such a situation, it is best to sleep with three pillows: one over each ear and one to chew on.

One fetching custom indulged in by airlines is their reluctance to be concrete about late departures, as well as the tendency to begin selling seats on new airliners while they are still on the drawing board. Having emptied many a coffee urn waiting around airport terminals tastefully decorated to resemble old railway depots, I always double-check my flight #13 with the little lady in the hotel ticket office. Recently, after a convention in St. Louis, I was reassured so many times that they started playing a recorded announcement every three minutes when I called up. Two hours after the scheduled "on time" departure, they were still insisting there would be no delay, so after selecting an "upper" on the overnight limousine to the airport I left the hotel. I raced into the airport (the next morning) to reconfirm my ticket and just in time, since the lady said flight #13 would take off in five minutes. In my joy at being on time, I grabbed my bag and dashed for the gate. After running up and down the runway for some 30 minutes without sighting the plane, I returned for more information. The lady smiled and said, "Doctor, if you had waited a moment, I would have explained —the plane was taking off from New York in five minutes, not St. Louis."

"Lady," I said, "where can a man get a drink?"

"Right through that door, sir," she replied, smiling with all the warmth of a professional pallbearer.

I picked up my bag again, but not wanting to dash off half-cocked (as the urologists say) I decided to try one more question.

"Lady," I said, "that is an unusual bar; in fact, it appears to be filled with parked cars. What is it, a new drive-in arrangement?"

"Oh! no, sir," she answered. "That's the limousine stand. You have to go back to the hotel in St. Louis for a drink."

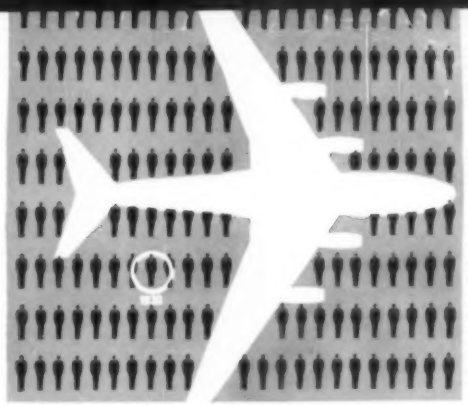
Someday, some psychiatrically oriented airline is going to place a little booklet in the pocket on the back of each seat for the nonfatalistic passenger to read and, maybe, remember. This little booklet would include such reassurances as: the motor may backfire without falling out of the wing, and a little smoke (i. e., enough to blot out the terminal) issuing from the exhaust when the motors are being started is not the first step toward having your ashes mailed to your next of kin. It wouldn't hurt to stress the fact that there is safety in numbers, particularly where motors are concerned. Also, it is as much a comfort to the passengers as to the pilot to have him make his way to the lavatory—provided he doesn't run or go too often. However, until some authentic information is compiled for the nonfatalist or until each passenger is provided with his own instrument panel, I'll go ahead and make my own diagnosis of each new noise I hear—and sleep as soundly as anyone else with a firm grip on the arms of the seat.

JACKSON A. SMITH, M. D.
Houston 25, Texas.

Aviation Week welcomes the opinion of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42 St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

THE STORY BEHIND THE STORY

60,000,000 FLYING AMERICANS BY 1960



FROM 384 THOUSAND PASSENGERS IN 1930 TO 60 MILLION passengers in 1960 – that's the forecast as flying moves into the age of jet and turbo-prop aviation. In other words, there will soon be 156 flying Americans for every 1 who flew 30 years ago!

SKILLED PILOTS will have accurate navigational information throughout every minute of the flight with the new specially designed Sperry SP-30 Flight Control System—which also aids in smooth approaches and landings. It is, in fact, a tireless assistant at the precise control of the plane.

ON-THE-DOT arrivals and departures will become more and more routine with the Sperry SP-30 Flight Control System helping the swift airliners to ride aerial highways automatically on schedule.

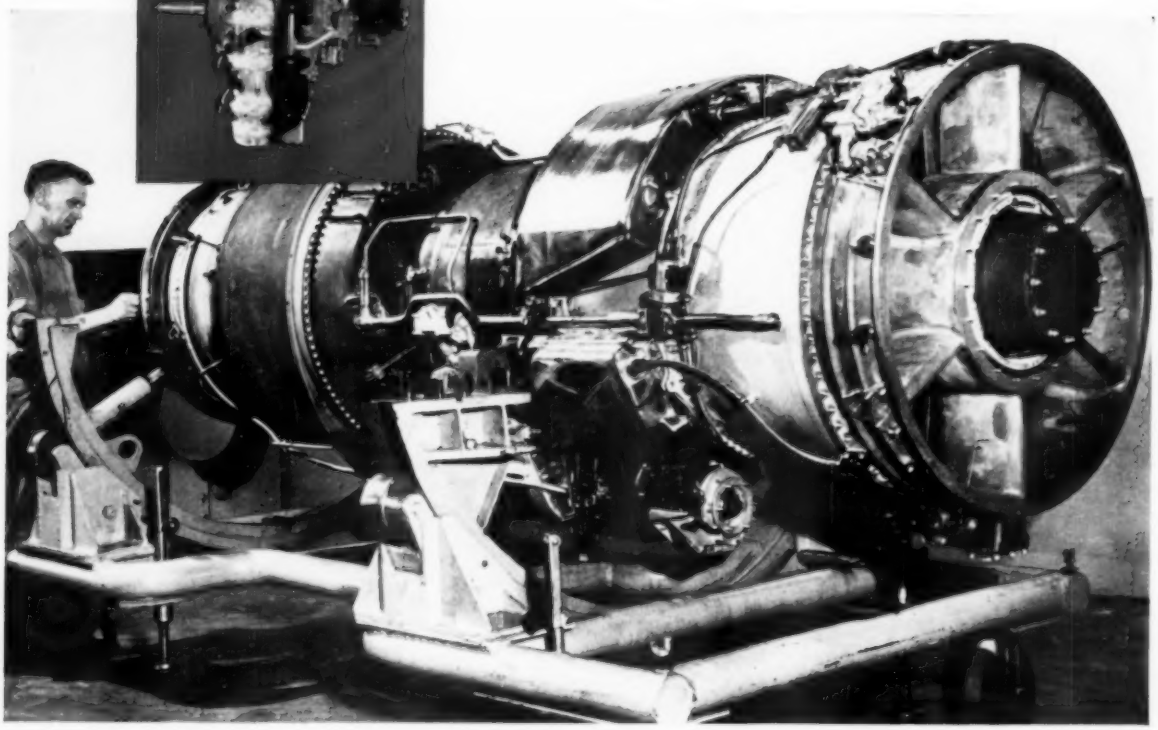
SPEED—COMFORT—SAFETY—all are emphasized in these giant new airliners that will whisk you smoothly from coast-to-coast in 4 hours—from New York to London in 6. Average speed will be well over 500 miles per hour—but you'd never know it as you fly high above storms and other disturbances in the calm, clear atmosphere.

In designing the SP-30 Flight Control System for jet and turbo-prop aircraft, Sperry has utilized more than 40 years of experience in aviation instrumentation and controls. From the beginning of aviation, Sperry has led the way in pioneering the developments in this field that have made airline travel today safer, more efficient and more comfortable.

SPERRY GYROSCOPE COMPANY
Great Neck, New York
DIVISION OF SPERRY RAND CORPORATION

E B POWER
UNIVERSITY MICROFILM
313 N 1ST ST
ANN ARBOR MICH

from Wasp Junior to J-57

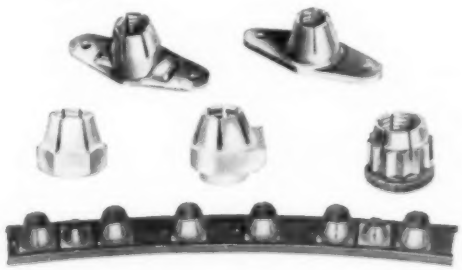


More than 25 years of engine development and the fasteners are still by ESNA

These two engines . . . built by Pratt & Whitney Aircraft over twenty-five years apart . . . dramatically reflect the evolution of aircraft power plants. Back in the early '30's engines rated at several hundred horsepower pulled air frames at speeds under 200 mph. Today the mighty J-57 develops over 10,000 pounds of thrust and rockets America's fighters through the skies at speeds faster than sound. Both of these power plants embody the finest design and high precision production skills of their era; and both engines use Elastic Stop® nuts for important fastenings.

During the past two and one half decades of power plant evolution, the greatest challenge presented to fastener manufacturers by the development of jet engines has been the increase in temperatures at which the fasteners must perform efficiently. ESNA offered the industry the first stainless steel, silver-plated, long-beam self-locking nut for performance at 1000°F. in 1947. And today ESNA is the first to produce a variety of locknut shapes manufactured from Type A286 stainless steel. These self-locking nuts will meet the full capabilities of currently produced A286 bolts at any temperature.

If you accept the practical value of more than two decades of this kind of field testing and of new development engineering to meet the needs of the industry . . . you'll rely on Elastic Stop nuts, too.



ESNA®

ELASTIC STOP NUT CORPORATION OF AMERICA

Dept. N3-1125, 2330 Vauxhall Road, Union, N. J.